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Institute of Metals Division Meeting

Fall Meeting Held in Conjunction With National Metal Week. Varied Program on Wrought Metals and Alloys

THE Institute of Metals Division held its Fall meeting in Buffalo, N. Y., October 3-7 as a part of the National Metal Congress at the Hotel Statler. Other Societies co-operating in this Congress were the American Society for Steel Treating, American Welding Society, Society of Automotive Engineers, American Society of Mechanical Engineers, The Wire Association and the American Drop Forging Institute. One of the features of the Congress was the exhibition of equipment and supplies for the metal products industries.

A list of those whose products are of interest to non-ferrous metal manufacturers is given below.

Metal Working Exhibits

Ajax Electric Company, Inc., Philadelphia.—Exhibiting (in operation): The newly developed electric ammonia dissociator which yields a dry gas containing 75% hydrogen and 25% nitrogen suitable for non-oxidizing furnace atmospheres, atomic hydrogen welding, reduction of metallic oxides, radio tube and lamp manufacture, etc. A display of photographs illustrating the construction and principle of operation of Ajax electric heat treating furnaces, including the continuous strip annealing furnace widely introduced in Europe during the past two years.

Ajax Electrothermic Corporation, Trenton, N. J.—Exhibiting: Photographs of equipment; a large easel with photographs mounted thereon, and also other photographs. Literature for distribution.

American Brass Company, Waterbury, Conn.—Exhibiting (in operation): Demonstrations of carbon and metal arc welding of Everdur metal. C. E. Swift, welding engineer, will conduct demonstrations. Set displays will include Everdur tanks, automatically welded, as well as other Everdur specimens welded by both gas and electric methods. There will be a display of iron castings repair welded with Tobin bronze filler rod.

American Cyanamid and Chemical Corporation, New York.—Exhibiting: Sales and technical representatives who will welcome an opportunity to discuss with those interested any metallurgical problems which may be presented. We will also have available for distribution to visitors literature describing the Aerocase process in its various applications in the heat treating shop.

Armstrong Cork & Insulation Company, Lancaster, Pa.—Exhibiting: Standard and special shapes of Armstrong's Nonpareil and E. F. insulating brick, also samples of these products coated with high temperature cement and also some samples faced with air proofing.

Aurora Metal Company, Aurora, Ill.—Exhibiting: "Stronger than Steel" die cast aluminum bronze parts for printing presses, locomotive blow-off valves, outboard motors, ironing machines, power lawn mowers, counting machines, variable speed mechanisms, dish washing machines, electric switches, hose couplings, catenary hardware, spray guns, telephone equipment, electric hand saws and sanders, gasoline meters, milk bottle capping machines, machine guns, dump trucks, etc. Die cast aluminum bronze gear and worm blanks. Die cast silicon bronze enclosed type centrifugal pump impellers.

Dow Chemical Company, Midland, Mich.—Exhibiting: A large display of Dowmetal parts including sand and die castings, forgings, extruded shapes, and sheet as well as a number of fabricated articles, such as foundry

flasks, bakers peels, couplings and many other products.

Grasselli Chemical Company, Cleveland.—Exhibiting (in operation): Many iron and steel and other metal products which have been processed by Grasselli products and processes. Part of this exhibit will be devoted to displaying the value and application of cadmium and zinc in its various forms for the protection of metal against rust and corrosion. A complete display of Grasselli fluxes, crystal and liquid, for the galvanizing, tinning, and soldering industries will be exhibited. Of special interest should

(Courtesy, American Brass Company)

Five New York City Electric Sub-Stations Use Everdur Pipe and Fittings to Drain Sulphuric Acid Waste From Battery Rooms.

be the display of Grasselli inhibitors. Demonstrations of pickling iron and steel in hot sulphuric acid solutions with and without inhibition will be carried on during the entire week of the exhibit. Many different grades and kinds of steel obtained from various mills will be pickled during these demonstrations. As pickling will be done in glass beakers, the efficiency of Grasselli inhibitors in preventing acid attack and hydrogen evolution will be plainly visible to those viewing the demonstration.

International Nickel Company, Inc., New York.—Exhibiting: Important applications of nickel alloys. Members of our Development and Research Department will be in attendance to discuss with visitors to the exhibition their problems in connection with the use of nickel alloy steels, nickel cast iron and nickel in non-ferrous alloys.

Metal & Thermit Corporation, New York.—Exhibiting (in operation): Materials and equipment for Thermit welding. Will also exhibit Murex heavy mineral coated electrodes for all purpose. Will have an operating exhibit showing welds actually produced with these electrodes.

Metallizing Company, Los Angeles.—Metal spraying equipment.

New Jersey Zinc Sales Company, Inc., New York.—Exhibiting (in operation): Many of the newer and more unusual examples of die castings—both as castings and units of complete assemblies. This year our exhibit will include a bench lathe, the assembly of which includes 44 zinc die castings—gears, brackets, spindles, etc. Besides these exhibits of moderately heavy machinery made largely of zinc die castings there will be many assemblies of smaller pieces ranging from completely utilitarian to decorative objects. A complete exhibit of platings and enamel and lacquer finishes on zinc die castings will also be shown.

Surface Combustion Corporation, Toledo, O.—Exhibiting (in operation): Diffusion forge and combustion burner; automatic proportioning burners—high and low pressure; oven furnaces; high speed muffle controlled atmosphere furnace; atmospheric air heaters.

(Courtesy, International Nickel Company)

Solid Nickel Silver Trap, Chromium Plated.

Roessler & Hasslacher Chemical Company, Niagara Falls, N. Y.—Exhibiting: Sodium cyanide, cyanide mixtures, and heat treating salts. Metallic sodium. A unit for demonstrating the electroplating of tin. Articles showing the application of cyanide in case hardening and electroplating.

THE TYPEWRITER

Another Wear and Tear Machine Which Is Die-Cast.

(Courtesy, New Jersey Zinc Company)

DR. JEFFRIES' TALK ON TUNGSTEN

The Semi-Annual Dinner of the Institute of Metals Division was held on Wednesday evening, October 5. The feature of this Dinner was a non-technical talk by Dr. Zay Jeffries, on Tungsten. Dr. Jeffries has been intimately associated with the development of the tungsten wire drawing industries from its earliest days and has helped to bring the manufacture of tungsten to its present high state in which wire can be regularly made with any type of grain desired.

Abstracts of Papers Read

CREEP CHARACTERISTICS OF METALS AT ELEVATED TEMPERATURES

By A. E. White and C. L. Clark

This paper discusses creep testing from some of its fundamental aspects. It begins by giving a brief historical development of physical testing, leading up to creep tests. Because of space limitations it only describes the creep testing equipment in use at the University of Michigan. It develops quite fully the methods employed in the plotting of data, pointing out the importance of selecting suitable ordinates. It shows the differences due to the single step, up-step, and down-step methods of loading —the lowest rate of creep being obtained by the downstep method.

It points out that in the logarithmic method of plotting stress versus rate of creep the slopes of the lines are, for the same metal, parallel to one another if below the recrystallization temperature; the lines are also parallel if above; but the lines for temperatures below, and those for temperatures above are not in themselves parallel.

The paper discusses in some detail the influence of grain size, chemical composition, methods of manufacture, heat treatment and rate of creep.

THE COPPER-RICH ALLOYS OF THE COPPER-NICKEL-TIN SYSTEM

By John T. Eash and Clair Upthegrove

After considering the various quasibinary systems and the ternary isotherms, the following conclusions were reached concerning the copper-rich alloys of the copper-nickel-tin system:

1. The solubility of tin in the alpha phase of the copper-tin system increases between 590° and 500° C. and then remains constant to room temperature.

2. The transformation in the copper-tin system between 15.5 and 25 per cent tin at 590° C., which was observed by Hoyt, Stockdale and others, is due to a change of the beta phase to alpha + gamma.

3. The liquidus of the bronzes containing up to 18 per cent tin is increased 7° C. for each per cent of nickel added up to 5 per cent. Above that amount of nickel the gradient diminishes to 5.7° C. at 20 per cent nickel.

4. Alloys containing up to 10 per cent nickel exhibit a greater temperature difference between the liquidus and the solidus horizontal above the alpha + beta field than do the simple copper-tin alloys.

5. The addition of nickel to copper-tin alloys causes the alpha solubility to increase on cooling below the solidus when the alpha is in equilibrium with the beta phase. The solubility of tin in the alpha decreases on cooling below the temperature at which beta changes to alpha + gamma. A new phase, theta, is then precipitated.

6. The alpha solubility at 500°, 300° and 25° C. decreases from 16 per cent tin at 0 per cent nickel to a minimum of approximately 1.2 per cent tin at 4 per cent nickel, followed by a gradual increase to slightly over 3 per cent tin at 20 per cent nickel.

7. The lattice parameter of the alpha phase of an alloy containing 2 per cent nickel and 12 per cent tin quenched at 780° C. is 3.680 Å. The parameter of the beta phase of an alloy containing 2 per cent nickel and 25 per cent tin quenched at 725° C. is 2.994 Å.

8. The addition of nickel raises the temperature of the beta transformation to alpha + gamma and causes the change to be more sluggish and to extend over a range of temperature. This transformation does not occur at constant temperature, but takes place at higher temperatures as the copper or nickel content increases.

9. The addition of nickel to the delta, phase of the copper-tin system causes it to change from a cubic structure to an anisometric structure, which has been designated as delta prime. Delta prime is a solid solution in which the solubility of copper and nickel increases on cooling below the eutectoid transformation; thus causing an absorption of part of the alpha.

10. The addition of nickel causes the gamma eutectoid point to move to higher tin contents.

11. In alloys containing 2 per cent nickel and at least 16 per cent tin, the gamma phase changes to alpha + delta prime on cooling through 539° C. Whether or not the eutectoid structure of alpha + delt prime is obtained, depends upon the rate of cooling. A rapid rate of cooling tends to give a fine eutectoid structure, while a very slow rate of cooling gives a clear delta prime phase in the low-tin alloys and a coarse eutectoid structure in the high-tin alloys. By slow cooling the alpha is given an opportunity to coalesce at the grain boundaries.

12. Alloys in the alpha + theta field containing at least 5 per cent nickel when cooled to room temperature may contain either a clear or dark-etching alpha matrix, depending upon the rate of cooling through the temperature range in which the alpha solubility decreases. A relatively fast rate of cooling causes the theta constituent to separate in a very fine precipitate in the alpha, causing a dark appearance on etching. A very slow rate of cooling allows the theta phase to coalesce to large grains and the alpha remains light in color.

SOME EFFECTS OF INTERNAL STRESS ON PROPERTIES OF DRAWN BRASS TUBES

By D. K. Crampton

1. Young's law of proportionality between stress and strain within the elastic limit does not hold directly for brass tubes drawn cold with varying types of reduction. The modulus of elasticity is maximum at zero load and falls off continuously with increase in stress.

2. Relief-annealed tubes more nearly approach strict proportionality between stress and strain than do tubes not relief-annealed. It is probable that a perfectly relief-annealed tube would have a constant modulus of elasticity within the proportional limit.

3. Relief annealing has no effect on maximum strength of drawn tubes or on apparent elastic limit. It does, however, markedly increase surface hardness where the stress released was tension.

4. The time mercurous nitrate test gives a good indication of internal stress from drawing or sinking.

5. There appears to be no method for determining intensity and distribution of internal stress which does not require a degree of precision of measurement not easily attainable, or which is not very cumbersome and difficult to use, or which does not suffer considerably in accuracy. The method used here for comparing differently prepared tubes is admittedly only a first approximation. It does, however, serve adequately to differentiate between the various tube-drawing treatments and brings out clearly differences in both amount and distribution of circumferential stresses which can be correlated with the action in the mercurous nitrate test. In general, in hollow sunk

tubes the stresses persist well into the tube wall, while in drawn tubes they fall off much more rapidly. In addition, the harmful type of stress distribution is accompanied by high surface stress, and vice versa.

6. There is considerable evidence that internal stresses in grain boundaries are materially higher than within the individual grains. At least polycrystalline tubes showed stresses from 29 to 55 per cent greater than identically treated single-crystal tubes.

7. There is a simultaneous increase of hardness of surface layers originally under tension and decrease of hardness of layers originally under compression when the stress is released by splitting. This shows that lattice distortion does not necessarily result in an increase of hardness, but under suitable conditions in a decrease.

8. The 70-30 brass tubes reduced 28 and 47 per cent in area by sinking or drawing show some evidence of preferred orientation. The type of preferredness in sunk tubes is such that a [112] direction is parallel to the tube axis, a [111] direction is radial, and a [110] direction tangential. In drawn tubes a [111] direction is parallel to the tube axis, a [110] direction is radial, and a [112] direction is tangential. These types of preferredness are different from those found by Norton and Hiller for mild steel tubes.

9. The possibility of some connection between type of preferred orientation and internal stress is suggested, and further work in this direction contemplated.

EARS ON CUPRONICKEL CUPS

By W. H. Bassett and J. C. Bradley

1. The edges of drawn cupronickel cups often have four ears. These may be produced either at 45° to the direction of rolling, or at 90° (and 0°) to the direction of rolling.

2. By systematically reducing the gage of cupronickel at which the intermediate anneal is introduced, a series of cups has been made in which the ears varied in regular fashion as follows: short 90° ears, long 90° ears, shorter 90° ears, no ears, short 45° ears, long 45° ears, short 45° ears, no ears.

3. Variation in composition of the cupronickel affects earing tendencies.

4. The length of the 90° ears increases with the final annealing temperature.

5. Earing evidently is due to directionalism in the arrangement of the crystalline structure and to methods of rolling and annealing which bring about directional arrangement.

DIRECTIONAL PROPERTIES IN COLD-ROLLED AND ANNEALED COMMERCIAL BRONZE

By Arthur Phillips and Carl H. Samans

1. The most pronounced tensile directional properties and the greatest earing tendency are obtained in a 90-10 brass given the greatest reductions followed by high temperatures of anneal.

2. The ordinary tensile test applied to strip brass cut at several angles to the rolling direction seems to be of significance in indicating whether or not annealed brass will form ears on drawing.

3. In slightly and moderately worked brass, the lower the temperature of the intermediate and next to the last anneals, the more marked are the directional differences as shown by both tensile and cupping tests.

4. Copper seems prone to form ears in and at right angles to the rolling direction. The 90-10 brass, as well as other brasses observed by the writers, drew with ears at 45° to the direction of rolling.

5. The directional properties of copper are quite different in character from those found in the 90-10 brass.

A STUDY OF SEGREGATE STRUCTURES IN COPPER-TIN AND SILVER-ZINC ALLOYS

By D. W. Smith

The beta solid solution phases of the systems copper-zinc, copper-aluminum, copper-tin and silver-zinc are structurally analogous. R. F. Mehl and O. T. Marzke have shown that the α phase upon segregating from the β phase in the system copper-zinc takes the form of needles lying parallel to a [111] direction or some similar direction, such as [556], of the parent solid solution, and that the α phase upon segregating from the β phase in the system copper-aluminum also takes the form of needles. By analogy they assume that in this case also the segregate needles lie parallel to the [111] or [556] direction in the β lattice.

The purpose of this investigation is to determine whether the structures resulting from segregation of the α phases from the respective β phases of the systems copper-tin and silver-zinc are analogous to those obtained by Mehl and Marzke in the systems copper-zinc and copper-aluminum.

PROPERTIES OF COPPER DEOXIDIZED WITH CALCIUM

By Lyall Zickrick

A high-calcium copper alloy has been found to deoxidize copper satisfactorily.

Residual calcium remaining in the metal, like residual silicon, raises the annealing temperature required to produce dead soft copper. As small an amount as 0.05 per cent residual calcium raises the annealing temperature of copper from 250° to approximately 350° C., and when calcium is present in amounts up to 0.20 per cent, the required annealing temperature is in the neighborhood of 400° C.

Owing to the very slight solubility of calcium in copper in the solid state, residual calcium does not decrease the electrical conductivity of copper as silicon does. For a specific illustration it was found that 0.03 per cent residual calcium dropped the conductivity of dead soft copper from 101 to 97 per cent, while 0.03 per cent residual silicon caused a drop of from 101 to 75 per cent.

L. L. Wyman has taken samples from the 10 ingots described here and has conducted an investigation of their microstructure and oxygen content as affected by the oxidation-reduction treatment. This treatment is essentially an anneal in an oxidizing atmosphere at 900° C. followed by an anneal in hydrogen at 800° C.

COPPER EMBRITTLEMENT

By L. L. Wyman

The interpretation of the results of the foregoing experiments lead definitely to the conclusions that:

1. The addition of calcium in small amounts, as represented by lot 2, gives superior qualities as regards resistance to embrittlement.

2. Excessive calcium additions prove detrimental to the physical properties (bend test) of copper, corroborating the work of Schumacher, Ellis and Eckel, and of Zickrick.

3. None of the calcium coppers appear to be detrimentally affected by the usual copper embrittlement; that is, the "gassing" or blowing open of the grain boundaries.

4. In all of the lots tested, the double deoxidizing has proved superior to single deoxidation, for similar or larger amounts of the same deoxidants. Lot 2 may be considered an exception to this statement.

Non-Ferrous Metals in Railway Electrification

By FRANCIS A. WESTBROOK
Mechanical Engineer

Uses for and Quantities of Metals Employed in Operating Railways by Using Electricity for Motive Power*

WHEN we come to consider the uses of non-ferrous metals in railroad electrification it immediately becomes evident that very large quantities of copper are involved. This, of course, is easy to understand, but what is probably not so clearly recognized is the impressiveness of the actual figures. For instance, overhead construction calls for 15,000 to 20,000 lbs. of copper per mile and some locomotives use 75,000 lbs. of copper for the electrical machinery which they carry.

In the first place, to give an idea of what railroad electrification means to the copper industry, the electrified railroads of the world used something over 500,000,000 lbs. of copper at the present time. Of the total mileage the United States has about one-fifth and this represents only 1% of the total track mileage of this country.

At this point a few figures will be interesting and enlightening. The Pennsylvania Railroad in its lines already electrically operated uses some 28,000,000 lbs. of copper, but 60,000,000 lbs. more will be required for the program of electrification now under way. The New Haven uses 10,000,000 lbs., the combined electrification of the Virginian Railway and the Norfolk & Western over the Appalachian Mountains 7,000,000 lbs. and the Mountain Division of the Great Northern 3,500,000 lbs.

Other well-known large scale American railroad electrification projects already completed and in service include that of the New York Central lines entering the Grand Central Station, using over 10,000,000 lbs. of copper, and the Chicago, Milwaukee & St. Paul with its 900 miles of electrified trackage involving the use of some 22,300,000 lbs. of copper.

In Great Britain a committee backed by Lord Weir of Eastwood has developed a plan for electrifying 3,600 miles of main line tracks and 15,500 miles of sidings which calls for 1,000,000,000 lbs. of copper. What this will mean to the copper producers when once well under way hardly needs comment. In addition to this other countries have important mileages of electrified roads now in operation, including Spain, Sweden, Austria, Japan, Italy, France, Germany and Switzerland. In all there are about 21,000 miles in service and practically all of these countries are planning extensive additions. For instance, Japan has a program for adding 400 miles within the next four years, not to mention Great Britain's ambitious plans as well as those of other countries. Italy is now working on 400 miles of new electrification and Germany has plans for adding some 1,600 miles, mainly in Silesia and the industrial districts of the Rhine. France is also active with a program of electrifying 5,500 miles of main line, of which about 875 miles have been placed in operation.

Perhaps the most sensational electrification, aside from Switzerland, is electrification in Norway and Sweden, much of which is within the Arctic Circle. Over 700 miles of road have been changed from steam to electric operation in Sweden and work is now going forward on 372 miles additional. Switzerland has 62% of its total railroad mileage electrified and leads the world in this respect. Of course the abundant water powers of these countries and their dependence on outside sources of supply for coal has had much to do with this extensive electrification, especially in Switzerland.

These figures relating to foreign countries will show how actively electrical traction is being adopted all over the civilized world, and how much copper producers in all lines have to gain from this widespread activity.

Furthermore, the power plants serving existing electrified roads in this country use about 10,000,000 lbs. of copper, the transmission systems 30,000,000 lbs., the substations about 6,000,000 lbs. and the locomotives and multiple-unit cars about 22,000,000 lbs.

Finally, it will be worth while to get an idea of the copper used in individual locomotives in order to see how important they are as consumers of this metal. Thus a double-unit Baldwin-Westinghouse engine for hauling 5,000-ton freight trains over the Cascade Division of the Great Northern Railway employs about 19,000 lbs. of copper in its construction. The new New Haven locomotives designed for a-c and d-c operation use about 25,000 lbs. each, the General Electric-Alco locomotives on the Chicago, Milwaukee & St. Paul road use over 30,000 lbs., the oil-electric locomotives used by the Canadian National at its Montreal Terminal use about 44,000 lbs., and the three-unit Baldwin-Westinghouse locomotives for the Virginian Railway use about 75,000 lbs. of copper. Multiple unit passenger cars on the Paoli Section of the U. R. R. use over 6,000 lbs. of copper each.

These figures certainly show what railroad electrification means to the copper industry.

Aluminum

Aluminum has come into extensive use for multiple-unit passenger cars for suburban service on electrified divisions of such railroads as the Illinois Central, Pennsylvania, Northwestern Pacific, Lackawanna, Reading and others. The principal object, it goes without saying, is to save weight. The amount saved varies from about 5%, or 4,700 lbs., to 10.5%, or 13,100 lbs., depending on the extent of aluminization and size of car, the average being somewhere around 7%.

The parts made of aluminum and aluminum alloys consist of doors, conduit, fittings, exterior finish, roof sheet, seats, sheets in superstructure, and in the case of the Pennsylvania cars the entire superstructure, including doors, conduit and fitting. The latter is the case where a saving of 10.5% in weight, or 13,100 lbs., was made.

In the case of the latter cars about 8,600 lbs. of alu-

*Previous articles by Mr. Westbrook on Metals in Transportation were published in our issues for January, February and April, 1932.

minum was used. The amount of aluminum used in the Illinois Central cars, including 120 trailers and 140 motor cars, averaged 4,985 lbs. per car, with an average saving in weight of 8,958 lbs. per car.

Other Non-Ferrous Metals

Uses of nickel, lead, tin, zinc with respect to the rolling stock of electrified systems are similar to those of the steam railroads. It seems to be impracticable to separate the quantities used in the two systems. Most of the remarks made relating to their uses in the article entitled "The Use of Non-Ferrous Metals by the Steam Railroads" in the February, 1932, issue of METAL INDUSTRY apply in this connection.

A recent development of Monel metal application in the field of railroad electrification is its use for bolts, screws and various fittings for outdoor electrical equipment because of its strength and resistance to corrosion.

Another type of car which should, perhaps, come under the steam railroad classification, is a light weight, self-propelled rail car with pneumatic tires. It may be either oil-electric drive or it may be equipped with motors only for an external source of power supply. The interesting thing from the present viewpoint is that a large part of it is made of welded stainless steel. Thus the cross bracerings of the trucks, underframe, car body and sheet are of this alloy. Maintenance with this construction is said to be very low.

Interurban Rapid Transit and Steel Railways

Accurate figures covering the uses of non-ferrous metals in this branch of transportation are extremely difficult to secure and the best that it seems possible to do is to suggest the conditions by giving such concrete facts as are available.

According to the Copper & Brass Research Association the following data, as of January 1, 1929, will give an idea of the extent of these lines:

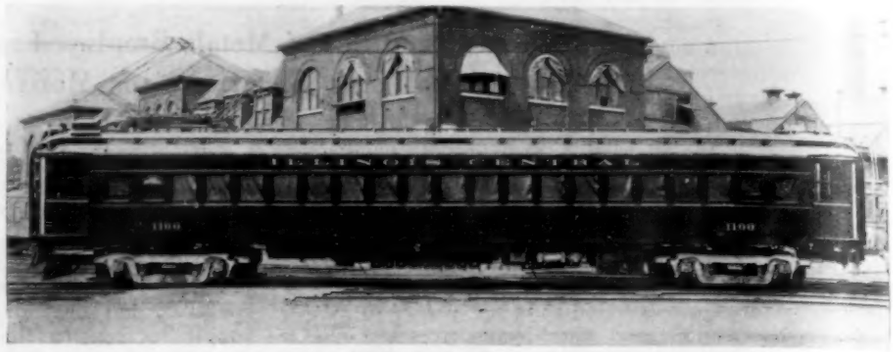
Number of companies	663
Electrified mileage	41,686
Motor passenger cars	67,901
Trailer passenger cars	7,189
Electric locomotives	476
Freight motors	2,477
Freight trailers	9,618
Motor service cars	8,113

Copper

The Copper & Brass Research Association estimates that 750,000,000 lbs. is a very conservative figure for the amount of copper in use on the interurban, rapid transit and street railways of the country. Probably it approximates 900,000,000 lbs.

An idea of the distribution of this enormous quantity may be gained from a consideration of two systems for which fairly complete figures are available. Both are interurban lines.

The first has 250 miles of track, or 100 miles of route, and owns its own transmission line. The total copper for transmission, conversion, distribution and contact amounts to 3,750,000 lbs. For equipment, including cars, the amount of copper is about 1,000,000 lbs. The total copper averages about 19,000 lbs. per mile.



Between 5 and 8 Per Cent of the Dead Weight of 260 Suburban Motor Cars and Trailers for the Illinois Central System Was Eliminated by Means of Aluminum Applications in the Superstructure. Twenty-five of These Cars Have Been in Successful Operation Since 1923.

The line has 120 miles of track. Copper for conversion, distribution and contact amounts to 1,620,000 lbs. and for equipment 280,000 lbs., making a total of 1,900,000 lbs. or 16,000 lbs. per mile. This lower weight of copper mile is accounted for, in part at least, by the fact that this company does not have its own transmission line.

Subway lines, such as the Interboro Rapid Transit in New York, run much higher because of the great density of the traffic. This system averages about 25,000 lbs. per mile. The same is true for the Brooklyn-Manhattan Transit and other similar systems.

Aluminum

Aluminum is now extensively used in the construction of trolley cars. In some cases almost the entire superstructure is made of this metal, as well as the side sills and trucks. In other cases, of course, aluminum is used for fewer parts.

An idea of the saving in weight may be gained from consideration of one or two types of construction. For instance, a certain car with a superstructure of aluminum the saving is 900 lbs. over steel construction, and with an aluminum underframe the saving is 4,500 lbs., making a total saving of 13,500 lbs., or 36%. This seems to be about the maximum saving, but in other instances savings as high as 28% and 29% in weight have been realized and running down to only 3%. The average seems to be around 10 or 12%.

As has already been pointed out, aluminum has long since passed the experimental stage in car construction and on account of its inherent advantages of lightness, the ease with which aluminum and its alloys can be worked and, in general, the lower maintenance because of its resistance to corrosion.

Figures giving the total quantities of aluminum in use are not available.

Other Non-Ferrous Metals

Of course lead, copper and zinc appear in very considerable quantities in bearing metals. Some lead covered cables are also used, especially in the underground feeder systems in city railways. In some instances the stanchions in trolley cars are made of monel metal and nickel cast iron is used for grid resistances.

British Institute of Metals Meeting

Synopses of the Papers that Were Presented at the Meeting

THE twenty-fourth Annual Autumn Meeting of the Institute of Metals was held, jointly with the Autumn Meeting of the Iron and Steel Institute, in London from September 12 to 15, 1932. It was attended by more than 300 members of both Institutes from many parts of the world. The opening session on September 12 was devoted to a lecture by Dr. H. J. Gough, of the National Physical Laboratory, on "Corrosion-Fatigue of Metals."

CORROSION-FATIGUE OF METALS

By Dr. H. J. Gough

Corrosion-fatigue of metals is defined as the behavior of metals subjected to cyclical stresses while exposed to an environment of an oxidizing nature, and is discussed accordingly in the lecture. Following a brief historical account, the nature of the general problem, the nomenclature employed, and the characteristics of laboratory tests are stated; representative failures in service are described. Consideration is then given to the general influences of chemical composition, heat-treatment, and cold-working on the resistance of metals to corrosion-fatigue, also of the effect of time, number of cycles, and corrosivity of environment as factors in the process. The available knowledge regarding the special case of corrosion-fatigue in steam is discussed, also the general characteristics of corrosion accelerators and inhibitors. It is shown that a recognition of the importance of oxygen as a factor in fatigue renders entirely reconcilable the results of many apparently unrelated observations which have been obtained in independent researches. Some fundamental facts regarding the nature of corrosion-fatigue can be deduced from observations of the changes of microstructure occurring under these conditions. Primary importance is attached to the behavior of protective films under the straining actions associated with cyclical stressing. Although a large field of research remains to be explored, yet, even at the present time, it is concluded that the mechanism of corrosion-fatigue can be reduced to an ordered sequence of chemical and physical events which are explicable in the light of existing knowledge relating to corrosion and fatigue phenomena.

MODERN WORKS PLANT AND EQUIPMENT FOR THE HOT-WORKING OF NICKEL AND NICKEL ALLOYS

By W. R. Barclay, G. A. V. Russell, and H. Williamson

This paper describes a modern plant erected in Great Britain as a result of experience in the hot-working of nickel and its alloys and a close study of the conditions under which similar work is carried out on the Continent of Europe and America.

The main features of the plant are:

(1) Hydraulic forging press.

(2) Hot-rolling mill, consisting of: (a) a universal-type mill with horizontal and vertical rolls for the production of sheet-bar and strip; (b) a three-high Lauth-type mill for the rolling of sheet-bar and small rectangular ingots into sheets.

A detailed description of each section is given with diagrams and illustrations.

Various prevailing methods of practice in other countries are compared and underlying principles discussed.

The text includes an outline of the methods of production adopted in working the plant.

The heating of sheet-bar for rolling into sheets is carried out in a specially designed electric resistance furnace which is described and illustrated.

The paper concludes with some general remarks on the hot-working of nickel and its alloys.

MOULD MATERIALS FOR NON-FERROUS STRIP INGOT CASTING

By G. L. Bailey.

Grey cast iron is the material most generally used for moulds for the casting of non-ferrous strip ingots. Cast-iron moulds are subject to two particular defects: (a) gas evolution from the face of the mould when this is overheated during pouring ("blowing"); (b) transverse cracking of the working faces. The conditions producing "blowing" have been studied and the gas has been found to originate in a reaction between the carbon of the iron and a superficial oxide film.

Transverse cracking of the cast-iron mould surface is due to stresses resulting from a high temperature gradient in the mould wall immediately after casting. Mild steel moulds, which are free from "blowing" and cracking, are liable to serious distortion resulting from such stresses.

Copper is considered the most satisfactory material for strip ingot moulds. Its high thermal conductivity prevents serious temperature gradients and consequent distortion. For high melting-point materials copper moulds are, with advantage, water cooled, but for alloys such as brass they can be used under certain conditions without any special cooling.

SOME REACTIONS OCCURRING IN HOT-DIPPING PROCESSES

By E. J. Daniels

The part played by fluxes has been investigated and a general agreement found with diverse processes. The contamination of the liquid metal—"drossing"—is shown to be an inevitable factor in hot-dipping, soldering, etc., and methods for controlling it are indicated.

The coating of steel with cadmium and lead by hot-dipping is shown to be accompanied by the formation of the compounds $FeCd_2$ and $FePb_2$, which act as insulating layers preventing further attack. These compounds rise to the surface of the liquid bath, have high melting points, and are magnetic.

The action of molten tin on 8 per cent "aluminum-bronze" is shown to be anomalous.

THE EFFECT OF PRESSURE ON THE LIBERATION OF GASES FROM METALS (WITH SPECIAL REFERENCE TO SILVER AND OXYGEN)

By N. P. Allen

The liberation of oxygen from silver during solidification has been studied by means of cooling curves. It is found that the gas is evolved when the "internal pressure" of the dissolved gas becomes greater than the hydrostatic pressure of the liquid metal, and that by applying a sufficiently large pressure to the liquid metal, the formation of blowholes can be prevented. The equilibrium of the silver-oxygen system is discussed and the existence of a eutectic shown. A method of eliminating blowholes in cast metals is recommended. The "internal gas pressures" developed in metals when gaseous constituents capable of interaction are present, are discussed.

ON THE REMOVAL OF GASES FROM ALUMINUM ALLOYS BY MIXTURES OF NITROGEN AND VOLATILE CHLORIDES

By J. D. Grogan and T. H. Schofield

Gas may be effectively removed from certain aluminum alloys by mixtures of nitrogen and certain volatile chlorides. Raw cylinder nitrogen may be employed. The quantity of chloride needed is small. Metal treated in this way possesses excellent mechanical properties.

RESEARCHES ON BERYLLIUM

By H. A. Sloman

Details of the research on the preparation of pure beryllium at the National Physical Laboratory are described. It is shown that with the progressive elimination of metallic impurities the brittle nature of the early metal was not greatly altered. This brittleness was subsequently found to be due to a beryllium/beryllium oxide eutectic surrounding the metal grains.

Most of the work has been directed towards the elimination of this oxide. Of all the methods attempted and described here, sublimation *in vacuo* has been the most effective. Even by this method it has not been possible to obtain sufficient metal for determination of its mechanical properties in the pure form. Comparatively thin films of the metal of over 99.9 per cent purity, have, however, been produced. From their properties it is suggested that pure beryllium is likely to be similar in mechanical properties to, for instance, iron—ductile, strong, and of medium hardness (Brinell hardness about 55-60).

During the course of the work a successful method of plating beryllium on other metals from fused electrolytes at temperatures of 600° C. and upwards was found.

Certain evidence that beryllium undergoes a transformation at room temperature has been obtained. Whether this change is associated with the residual impurities or with an allotropic transformation is not yet determined.

SOME ATTEMPTS AT MAKING BERYLLIUM-MAGNESIUM ALLOYS

By R. J. M. Payne and J. L. Haughton

A description is given of various methods which were tried for the production of beryllium-magnesium alloys, all of which were unsuccessful.

THE CONSTITUTION OF THE LEAD-TIN ALLOYS

By D. Stockdale

An investigation of the constitution of the lead-tin alloys is described. The micrographic method, two thermal methods, and a modified electrical conductivity method have been used in the determination of the solubility of tin in lead, which is shown to be 19.5 per cent by weight, at the temperature of the eutectic. This value is considerably higher than any other previously obtained. It is also shown that at ordinary temperatures lead probably cannot hold more than 2 per cent of tin in solid solution. The cause of the evolution of heat in certain of the alloys at a temperature just below that of the eutectic is discussed. No definite conclusion has been reached, but two explanations are put forward, and it is also shown that the allotropic theory is probably untenable.

THE EFFECT OF DIFFERENT ELEMENTS ON THE ANNEALING AND GRAIN-GROWTH CHARACTERISTICS OF ALPHA BRASS

By M. Cook and H. J. Miller

An examination has been made of the effect of additions of iron, phosphorus, manganese, and aluminum separately, and of aluminum with nickel, and aluminum with silicon, on the annealing characteristics of alpha brass by determining diamond pyramid hardnesss values and making grain size measurements on cold-rolled alloys annealed at various temperatures, while the tensile properties on a number of alloys representative of the various series investigated have also been studied. Some of the elements added have the effect of increasing the intrinsic hardness of brass and of raising the temperature of softening and recrystallization, but all exert a retarding influence on the annealing process subsequent to the initial softening, the extent of which varies with the nature and amount of the addition. This retarding influence, which markedly affects grain growth as well as the physical properties, is shown as a deflection on curves connecting hardness values and tensile properties with annealing temperature.

LIQUATION OR "INVERSE SEGREGATION" IN THE SILVER-COPPER ALLOYS

By J. H. Watson

(1) The behavior of silver-copper alloys in regard to the segregation of their constituents during solidification, which is usually referred to as "liquation" or "inverse segregation," has been further investigated.

(2) It has been established that the first formed primaries, whether of silver or of copper, are free to move under the influence of gravity, when the alloy is maintained for sufficient time at temperatures between the liquidus and the solidus.

(3) It has also been established that the primaries which have segregated under the influence of gravity are repelled from their position by the application of severe local chilling to their vicinity.

(4) All the effects of "liquation" and "inverse segregation" observed in these alloys in ordinary practice can be explained by the formation of primaries at the chilling surfaces of moulds and between the temperatures corresponding with the liquidus and the solidus, followed by their immediate migration towards the hotter portions of the mass.

MECHANICAL PROPERTIES OF NICKEL WIRES

By C. E. Ransley and C. J. Smithells

The paper presents data on certain mechanical properties of fine nickel wires. The materials used include commercial nickel, refined nickel prepared by melting in hydrogen, and the same material with small additions of the elements commonly present in commercial nickel. Measurements have been made to determine the following:

(1) The effect of wire diameter on the tensile strength and elongation of commercial nickel after annealing at various temperatures.

(2) The effect of temperature of annealing on the tensile strength and elongation of all the materials mentioned above in the form of wire 0.0425 mm. in diameter.

(3) The short-time tensile strength of the same wires at temperatures up to 1,000° C.

(4) The breaking strength of commercial nickel wire 0.0425 mm. in diameter under prolonged loading at temperatures up to 1,000° C.

ATMOSPHERIC ACTION AS A FACTOR IN FATIGUE OF METALS

By H. J. Gough and D. G. Sopwith

A review of the literature of corrosion-fatigue reveals many apparent inconsistencies but a closer examination indicates that such is not the case if it can be shown directly that atmospheric corrosion enters, to a varied extent, into the mechanism of fatigue as exhibited during the usual type of fatigue test in which the surface of the specimen is exposed freely to the atmosphere. In order to obtain this direct evidence, a lengthy series of comparative tests has been made in air and in a partial vacuum, on a range of ferrous and nonferrous metals and alloys. The results show definitely that the fatigue strength is, in general, improved by the substitution of a vacuum for air as the ambient condition. Various metals are affected to various extents, the maximum improvement obtained, in the tests, representing an increase of 26 per cent in the case of 70:30 brass.

THE DISTORTION OF WIRES ON PASSING THROUGH A DRAW PLATE

By G. I. Taylor and H. Quinney

Composite copper wires ⅛ in. in diameter, each consisting of two wires of semi-circular section, were pulled through various draw plates. Photographs are reproduced showing the distortion of the cross-sections. These are treated in a quantitative manner, measurements of the ratio of distortion to increase in length being found for various reductions in area and angle of taper. The principal results are: (1) when an annealed wire is drawn through successive holes in a draw plate, each of 3° taper, so that it suffers equal proportional reductions in area at each draught, the distortion of the cross-section rapidly diminishes until (in the example of Figs. 1-6) it has ceased to be measurable after four draughts; (2) for any given reduction in area the distortion increases as the angle of taper increases; (3) when the reduction in area is small and the angle of taper large so that the length of wire in contact with the drawhole is small compared with its diameter, the distortion of the central part is independent of the angle of taper, but the distortion in the outer part increases as the angle of taper increases; (4) for a given reduction in area and angle of taper the distortion in the outer part of the wire is greater when the drawing is done in two stages than when the whole operation is done in one draught. The distortion in the central portion is the same in the two cases; (5) the fact that the distortion of the outer part of the wire varies so much with the angle of taper of the drawhole, whilst the inner part is little affected, seems to explain why different X-ray analysts obtain consistent results for the structure of the inner parts of drawn wire, but widely divergent results for the outer layers.

A MODIFIED IMPINGEMENT CORROSION APPARATUS

By H. W. Brownsdon and L. C. Bannister

Owing to difficulties experienced with apparatus hitherto used for carrying out impingement corrosion experiments, a modified apparatus has been devised which is simple in design and permits of the ready control of the many factors influencing this type of corrosion; details are given regarding its construction and use. Some preliminary results obtained are given as illustrating the use of the apparatus in the study of corrosion phenomena.

THE OPEN-AIR CORROSION OF COPPER. PART III.—ARTIFICIAL PRODUCTION OF GREEN PATINA

By W. H. J. Vernon

Following on the observation that the "natural" green patina on copper consists normally of basic copper sulphate, methods have been worked out for the rapid production of an artificial patina of this substance. Treatment with ammonium sulphate solution followed by a solution in which basic copper sulphate is suspended gives a green patina, which, however, breaks down under severe weather conditions. A patina stable under the latter conditions is produced by anodic treatment for 15 minutes in a suitable electrolyte; it has a good green color and is quite insoluble in water. The deposit on leaving the bath has a composition represented by the formula $CuSO_4.Cu(OH)_2$; on exposure to the open air a progressive increase in basicity takes place, leading ultimately, it is believed, to the formula

$$CuSO_4.3Cu(OH)_2.$$

Certain synthetic coatings other than basic copper sulphate, although initially green, readily blacken on free exposure to town air. The application of linseed oil and more especially of lanoline to the primary coating gives marked protection to the underlying metal, but does not prevent discoloration; water glass and silicon ester, on the other hand, appreciably increase the corrosion.

TWO YEARS' CORROSION TESTS WITH DURALPLAT IN THE NORTH SEA

By K. L. Meissner

Corrosion tests were carried out with Duralplat from January 7, 1930, to January 8, 1932, in the North Sea at the Isle of Norderney. The specimens consisted of strips of 4 different thicknesses, drawn profiles of 2 thicknesses, and riveted strips. With the exception of the last-mentioned, all samples were exposed in two series, i. e., at ebb and flow of the tide and always under water. Samples were taken every three months.

The appearance of the surface, loss in weight, reduction in yield-point, tensile strength, and elongation were noted and the type of attack was examined microscopically. The last-named was especially useful in the case of riveted strips.

Powdered Metals By Electrolytic Methods

By Dr. JOSEPH ROSSMAN
Washington, D. C.

An Extended Review of the Patents Covering This Method of Manufacturing a Material Which Has Aroused Great Interest and Seems to Have a Wide Field—Part 2*

9. 1,092,206, Ellis. Apr. 7, 1914.

Finely divided nickel for catalytic purposes is made as follows: Two electrodes of pure nickel in bar or rod form are connected one to the positive and the other to the negative pole of a source of electricity. The ends of the nickel rods are dipped in water and brought in contact, then separated so as to form an arc under the water. This results in the production of nickel material usually of a brown to blackish color in a state of more or less fine division, some of this material often being so fine and flocculent as to remain suspended in water for several days. The resulting sludge is evaporated to dryness when a very light nickel material is obtained, which may be used at once as a catalytic body or may first be reduced in hydrogen or other reducing material Or, the wet sludge may be heated with oil to expel the water in order to produce a form of nickel which remains suspended in oil for a long period and this may be used as catalytic basis. In such a case it is usually well to heat to 230-250 degrees C. in the early stage of the hydrogenation treatment and after a time the temperature may be reduced to 200 degrees and lower.

10. 1,251,302, Tainton. Dec. 25, 1917.

In carrying out the invention the solution which is to be treated—as for example dilute aurocyanid solution obtained in leaching gold or silver ores—is caused to flow through a vessel in which the electrodes are placed; and the apparatus is so designed as to cause a rapid motion of the cathode relatively to the solution, or vice versa. This may be accomplished, for example, by imparting to the cathode or to the solution a rotary or reciprocating motion.

The nature of the solution is such, and the distribution of the current on the cathode is so arranged, that the metal is precipitated in a loose, spongy or otherwise non-adherent form, so as to be easily detached by the scouring action of the solution arising from the frictional resistance between the solution and the cathode. The deposition of the metal in this form may be effected in most cases by electrolyzing the solution with a current of high density. Where the nature of the solution is such as to interfere with the deposition of the metal in the form described, other substances may be added to the solution in order to produce the desired results, as for example, small quantities of zinc or lead salts or finely powdered graphite or oily materials.

11. 1,254,056, Moore. Jan. 22, 1918.

Copper powder is made by using the following apparatus: The container 1 of glass contains an electrolyte 2, the character of which depends upon the metal to be obtained. (See Fig. 3.) If copper powder is desired this electrolyte will be copper sulfate solution. A heavy copper anode 3, by dissolving under electrolytic action, keeps up the concentration of the electrolyte as the metal is deposited on the copper cathode. 4. When a current of high density is used, copper is deposited out on the cathode in the form of fine powder which loosely collects thereon, as indicated at 5 on the drawing. The powder must not be allowed to accumulate on the cathode to any great extent for it naturally increases the surface of the cathode which at the same time cuts down the amperes per square inch cathode surface. It is desirable to keep the current density somewhere near constant in order to have the deposit of uniform character and therefore some manual or automatic arrangement is used to tap the cathode gently at short intervals. The powder should be removed at least every 5 or 10 minutes by tapping the cathode.

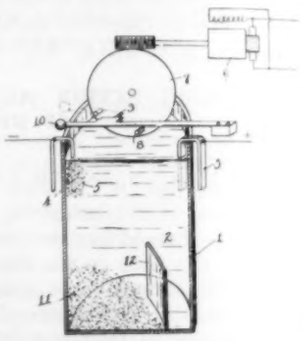


Fig. 3. Apparatus for Making Copper Powder.

To remove the powder automatically, a clock, motor or other arrangement can be used. An electric motor 6 is geared through the requisite number of gears to a wheel 7 having a pin 8 which rises under a portion 9 of a tappet 10 and raises the latter to the position shown in dotted lines in the figure, where the pin will clear the portion 9 and the tappet will spring downward under its own resilience to hit the cathode and remove the powder. This powder collects in a pile 11 at the bottom of the container and can be removed periodically in any manner.

When the powder is fresh from the electrolyte it is in a very pure condition on account of the method of preparation, but if allowed to stand after washing out the copper sulfate solution, it will more or less change over into copper oxid. Drying in vacuo after washing out the copper sulfate solution, reduces this action, but it does not eliminate the difficulty to a sufficient extent to permit the powder to be used in making brushes.

Oxidation can be prevented by washing the powder with a liquid containing such materials as glucose, tannin, or other colloids, and thereby cause a precipitation of the colloids as a thin coating on the metal particles due to the action of the copper sulfate electrolyte. It is advisable to arrange the apparatus so that the oxid, which is formed in small quantities at the anode, will not drop into and contaminate the copper powder. There are various ways of doing this, one of which is by placing a non-conducting partition 12 through the center of the lower part of the

*Part 1 was published in our August issue.—Ed.

container, so that the copper powder will not settle under the anode in position to be contaminated with the oxid. Another very efficient way of solving the problem is to inclose the copper anode in a cloth envelope or screen which will allow the electrolyte to readily percolate through it, but which will prevent the oxid from falling to the bottom of the cell.

12. 1,365,140, Adam, Stevenson, Mabbitt and Fieldhouse. Jan. 11, 1921.

The invention consists in the electrolytic deposition of metals in a non-coherent or loose crystalline form in a cell having a rotating cathode and employing a substantially uniform flow of electrolyte between the electrodes adapted to insure approximately uniform composition within the cell, and to enable high current densities to be utilized. The electrolytic cell used comprises a casing, a rotatable cathode and a hollowed out anode in which the cathode may be rotated. Passages are provided through the anode and casing for circulation of the electrolyte.

13. 1,397,008, McGall. Nov. 15, 1921. (German 362.181).

Zinc powder is prepared in non-oxidized condition as follows: Sheet zinc, which has been amalgamated is coated by rubbing with a thin layer of a suitable oleaginous substance, such for example as an organic or inorganic (hydrocarbon) oil or grease. The mineral grease known to the trade as "sponge grease," and having the characteristics of a non-flowing grease or oil, is entirely satisfactory for this purpose.

The coated sheet is then connected as the anode in a suitable electrolyte, which is preferably acid, and may consist initially of a sulfuric acid solution having a specific gravity of about 1.3. A cathode of zinc also coated with an oleaginous coating is used.

Undirectional current from an outside source is then caused to flow from the coated sheet zinc as anode, whereupon, irrespective of the current density employed, a deposit of sponge or minutely subdivided zinc will be formed. This deposit is at most only loosely adherent to the cathode, and may be either continuously or intermittently removed from the electrolyte.

14. 1,440,502, Slepian. Jan. 2, 1923.

This patent describes the preparation of metal powders by passing a low frequency current between metallic electrodes immersed in an electrolyte. (See Fig. 4.) As shown in the illustration, the apparatus used consists of a suitable electrode construction comprising a tubular body 8 of copper, the wall of which is perforated as at 9, the portion of the body immersed within the electrolyte being provided with a porous covering 10 of cotton or asbestos.

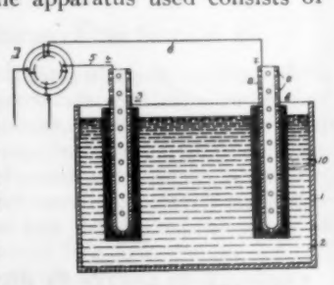


Fig. 4. Apparatus Using Low Frequency Current.

A current of suitable density, which may approximate one ampere per square inch of electrode area, is passed between the electrodes, and its direction of flow is reversed at suitable intervals, such as from 4 to 5 seconds. Under these conditions the copper passing into the electrolytic bath from an electrode during the flow of current in one direction will be deposited upon the electrode as a non-adherent powder during passage of the current in the opposite direction, and the resultant suspension or colloid solution may be withdrawn from the interior of the electrode by a pipette or equivalent device from time to time. This colloid solution may, obviously, be treated by filtration, evaporation or equivalent means to obtain a fine metallic powder.

15. 1,732,179, Bruening and Schneider. Oct. 15, 1929. (French 638,013.)

The process for manufacturing nickel flakes for use as admixture in the active material of alkaline accumulators comprises forming a sheet of coherent layers of nickel, cutting the sheet of nickel layers into small pieces, and subjecting the pieces to the action of a weak acid solution which slowly attacks the nickel and penetrates between the layers developing hydrogen which forces the individual layers asunder. In this process after each layer of nickel is deposited it is anodically polarized before the next layer is plated so as to make the layers separable.

16. 1,761,016, Koehring & Short. June 3, 1930.

Wet copper powder is dried by depositing it in a relatively thin layer on a foraminous support, first forcing air heated to approximately 100 degrees C. through the powder for a time insufficient to cause oxidation of the copper, and later progressively decreasing the heated air temperature until the copper powder is dry.

17. 1,777,371, Koehler. Oct. 7, 1930.

According to this process copper powder is prepared having a uniform and regular size. This powder is soft and feathery or flocculent, that is, each particle has a body of irregular or fixed or characteristic shape with rough edges and sharp-pointed extremities and while these shapes vary somewhat they are all generally similar. For example, when copper particles of this invention are viewed in profile under the microscope they are jagged and may be said to resemble the edges of a Killarney fern. These feathery particles possess the property of matting together under pressure and may be compressed or worked into various shapes and articles by known processes involving compression, heat treatment and the like but without requiring any binder and when so compressed or shaped the resulting article is dense, relatively non-porous and has a much higher tensile strength, elongation and hardness than similar articles made of the prior powder and containing the slender rod particles or the dense compact bodies. The following is a specific example of the conditions under which the copper powder may be produced. An electrolyte is prepared containing in solution between about ½ and about 3½ per cent by weight of copper, preferably about 2 per cent, and between about ½ and about 10 per cent by weight of free acid, preferably about 6 per cent. The temperature of the bath may range between about 35 degrees F. and about 200 degrees F. but preferably is kept between about 70 degrees F. and about 100 degrees F. The electrodes are spaced apart about 3 inches. The current may range between about 40 amperes and 240 amperes per square foot of cathode area with about 70 amperes being preferable with the above preferred conditions. The voltage may vary from 7 to 2 depending on the acid content with about 2 volts being suitable under the above preferred conditions.

When operating under the above preferred conditions metal powder will be deposited on the cathode. This powder should be completely removed periodically from the cathode for otherwise the deposit changes rapidly and contains an increasingly large content of dense compact copper of the prior art. This change is apparently controlled by the current density and length of deposition period between the steps of removal of deposit from the cathode. In general these variables may be summarized by the statement that a current flow of about 12 ampere hours per square foot of cathode area between the steps of removal gives satisfactory metal powder; that is, employing about 70 amperes for a ten minute interval.

This review will be continued in an early issue.—Ed.

Electrochemical Society Meeting

Papers Read on the Plating of Nickel, Cadmium, Brass, Co-Deposition of Lead and Bismuth, Zinc, Throwing Power and Gases in Metals

THE sixty-second meeting of The Electrochemical Society was held in Cleveland, Ohio, September 22-24, 1932.

In addition to the large Technical Program, abstracted below, the activities of the meeting included trips to industrial plants, interesting exhibits of an electrochemical nature, and various recreational features such as golf, dancing, etc.

Abstracts of Papers

ULTRA-RAPID NICKEL-PLATING IN FRANCE

By MARCEL BALLAY

The recent introduction of chromium plating into France stimulated research in nickel plating, with a view to improve upon methods which were slow and confined to non-ferrous articles. At the laboratories of Leon Guillet in Paris, where the investigations were carried out, results favored the hot single sulfate bath, operated at high current densities (up to 10 amp./sq. dm.). From a commercial point of view this bath is far superior to the old cold bath used in France and operated at low current densities. The laboratories also recommended to the French platers the conveyor system for further reduction in operating costs. Details of a typical installation near Paris are given, and emphasis is laid upon the nickel plating of steel articles. In conclusion the plating of nickel on aluminum and aluminum alloys is reported upon, calling particular attention to the use of the clear, hot, ferric chloride pickle preliminary to plating. This has been found to be applicable to a wide variety of aluminum alloys and superior to any other pickles heretofore used.

THE ELECTRODEPOSITION OF CADMIUM FROM CADMIUM SULFATE SOLUTIONS

Part I. The Effect of pH, Current Density, and Temperature on the Crystal Size of the Deposit, the Current Efficiency and the Electrode Efficiency Ratio

By S. WERNICK

The electrodeposition of Cd from $CdSO_4$ solutions was studied, with the object of determining the effect of variation of pH of the solution, current density and temperature of the electrolyte on the crystal structure and grain size of the deposit; and on the anode and cathode efficiencies and the electrode efficiency ratio. The pH of a simple solution of $CdSO_4$ rises rapidly with progressive deposition, and requires to be buffered in order to maintain a uniform pH. At the same time, the crystal structure of the deposit becomes progressively less granular, but subsequently (at a pH above 6), more crystalline, dark and less adherent. An optimum range of pH is approximately 5 to 5.7. The effect of aluminum sulfate, sodium acetate, boric acid and sodium chloride as buffering agents was examined. The best buffer within the desired range of pH was a mixture of boric acid and sodium chloride. $CdSO_4$ solution with this buffer was adopted as a standard electrolyte.

Increasing c.d. has only a small effect on anode and cathode efficiency, the variation being 1.6 per cent and 1.4 per cent respectively, and the electrical efficiency ratio is also little affected. There is however a marked effect on the grain size of the deposit, which consists of large crystal aggregates at low c.d. and is relatively fine grained and also more adherent at higher c.d. "Treeing" occurs when the c.d. exceeds 4.5 amp./s. dm. Increasing temperature has a relatively more marked effect on the electrode efficiencies than c.d. The anode efficiency rises notably at the higher temperatures examined, and the cathode efficiency decreases somewhat, resulting in a progressive increase in the electrical efficiency ratio. The effect on the deposit is at first in the direction of refinement of the grain size, but at higher temperatures, a coarser, crystalline structure develops. It is concluded that temperatures in excess of 40° to 50° C. are undesirable in depositing Cd from $CdSO_4$ solutions. The "structureless" type of deposit obtainable from cadmium cyanide solutions is unobtainable from $CdSO_4$ solutions in the absence of an "addition agent."

THE THROWING POWER OF PLATING BATHS

By MAX SCHLÖTTER and JOACHIM KORPIUN

A number of mathematical equations are derived with the aid of which the throwing power of commercial plating baths may be calculated. The equations embody cathode polarization voltage, conductivity of the bath, operating current densities, and current efficiency. The equations derived apply to electrodes of a wide diversity in shape, in size of bath, and in spacing of electrodes.

COMPLEX CYANIDES IN BRASS PLATING SOLUTIONS

By L. C. PAN

In literature on cyanide solutions containing both copper and zinc, the complex cyanides have been generally represented by $Na_2Cu(CN)_3$ and $Na_2Zn(CN)_4$. By analyzing brass electroplating solutions of known composition by various volumetric methods, the author proved that the complex compounds in such solutions are $Na_2Cu(CN)_3$ and $NaZn(CN)_3$ and not $Na_2Zn(CN)_4$.

IMPROVED METHOD FOR THE ANALYSIS OF GASEOUS ELEMENTS IN METALS

By N. A. Ziegler

An improved graphite vacuum fusion method for determination of gaseous elements in metals is described. It consists essentially in melting a sample in vacuum in a graphite crucible, collecting gases (CO, H_2 and N_2) evolved, and analyzing them by modified "Ryder" method, i. e., selectively freezing out different gaseous constituents, expanding them into known volumes, and measuring manometer deflections. The accuracy of the present method is ±0.003 per cent or beter. It is particularly advantageous for small samples, containing small amounts of gaseous elements.

CO-DEPOSITION OF LEAD AND BISMUTH

By Colin G. Fink and Otis H. Gray

Good, adherent, smooth deposits containing both bismuth and lead are obtained with: lead 9 grams, bismuth 9 grams, and perchloric acid 93 grams per liter, 5 drops of oil of cloves as addition agent, the temperature being kept at 40° C., current density at 1.2 to 3.6 amp./sq. ft. (0.13 to 0.4 amp./sq. dm.). Good deposits of bismuth, smooth and adherent, are obtained under similar conditions excepting that bismuth alone is present in the bath. The percentage of lead in the deposit increases with increase in current density. The alloy deposits containing about 75 to 85 per cent lead, balance bismuth, are most resistant to dilute hydrochloric and sulfuric acids.

ANODES FOR ZINC PLATING

By George B. Hogaboom and A. K. Graham

A study of zinc and zinc alloy anodes for zinc plating was made in both acid and cyanide electrolytes. Alloys of aluminum-zinc, mercury-zinc and aluminum-mercury-zinc have been compared with "horse head" zinc with respect to their structure, current efficiencies, popularization, sludge formation and solution maintenance. A 0.5 per cent aluminum, —0.3 per cent mercury-zinc anode is recommended.

DISCOLORATION OF CADMIUM PLATE AND ITS PREVENTION

By Gustaf Soderberg

Cadmium plates from cyanide solutions discolor when stored without air circulation, particularly in warm and humid weather. The discoloration is greatly accelerated when a nitric acid bright dip has been used. The discoloration is probably caused by the action of moist ammonia fumes, formed by the disintegration of cyanide or ammonium salt residues on the surface of the plate. Discoloration can be avoided by means of immersion of the plate in an oxidizing solution prior to the final rinsing and drying. The oxidizing solution should not in itself cause staining of the plate. Known bright dips for cadmium plate are acidic, and dissolve cadmium without gas evolution. The nature of their action appears to be specific. A suitable bright dip which also prevents tarnishing consists of a chromic acid solution containing active acid radicals.

PROPERTIES OF LOW pH NICKEL PLATING BATHS. I. Throwing Power, Cathode Current Efficiency and Conductivity

By L. C. Flowers and J. C. Warner

This first paper of a series presents data on the throwing power, current efficiencies and conductivity of low pH nickel plating baths. At low current densities the throwing power of the low pH baths is inferior, but at high current densities values approaching those possessed by high pH baths are obtained. Elevated temperatures and high nickel concentrations greatly aid the throwing power of the low pH solutions. With low pH baths, containing high nickel concentrations, operated at high current densities and at elevated temperatures, cathode current efficiencies of 94 to 99 per cent have been obtained. The conductivities of nickel plating solutions have been measured at various temperatures from 25° C. to 70° C., and have been used to correct throwing power values as measured in a Haring Cell.

Valve Casting Practice

Q.—I am hoping shortly to join a firm who are putting on the market a high pressure steam valve. I know that they are having trouble with the castings that they are buying from a jobbing brass foundry. I do not know whether the trouble lies in the core sand, or in the mixing of the metal. All the trouble seems to be in the body castings. The castings leak and the core leaves the inside of the casting too rough. I would like to know the kind of moulding sand to use; the kind of core sand and mixture used; the core wash used. If a core drier is used, what kind of metal is used for core driers? The exact mixture for the bodies? The exact mixture for the rest of the fittings? Whether the larger bodies should be clamped, stood on end, and poured through the finger holes, or poured on the flat. How long should the castings be left in the sand after pouring? Do you think the coke-fired pit furnace the best for such work? What temperature the metal is poured?

A.—No. 1.—The kind of moulding sand for valve work; we suggest No. 2 Albany or similar sand.

No. 2.—Core sand for valve work. We suggest:
2,000 pounds silica or rock sand
1,000 pounds old No. 2 molding sand
40 pounds Dextrine.

Temper with water. Use 1 part core oil to 70 parts sand.

No. 3.—Core wash. When necessary, we suggest Bull Run Talc diluted with molasses water ½ pint to the gallon of water.

No. 4.—Core driers, aluminum or aluminum bronze.

No. 5.—The exact mixture most all valves are made from: 85 copper, 5 tin, 5 lead, 5 zinc. This mixture is good for the trimmings, also.

No. 6.—Pour flat. To get color on body castings let stand in the mold from 7 to 9 minutes, and dip in water and blow out the cores. This will give you a nice, clean, smooth casting inside and out. Pouring temperature, 2,000 to 2,100 Fahr. Crucible furnace, either coke or oil.

Secure a first class melter. This is important as most of the loss on valve work due to leaks is due to improper melting of the metal. W. J. Reardon

The Preparation of Metals for Electroplating

A Complete Schedule of the Practical Operations Involved, in the Cleaning of Metals of All Kinds, the Removal of All Types of Dirt, Oil and Grease Before Plating—Part 2*

THE water break test has been referred to many times and, no doubt, every plater is familiar with this method of determining the complete removal of oil, grease and fat from work. A few thoughts on this subject may prove helpful, however.

The Water Break Test

A surface with oil, fat or grease present will not hold a solid film of water. Water rapidly breaks away from oil. If no oil is present and the surface is chemically clean, the water will cover the surface uniformly and will drain uniformly by gravity from a vertical or inclined surface.

The method of making a water break test is to immerce the work in **cold** water, lift from the water without shaking, hold the work in a vertical or a 45° angle plane, and closely observe the film of water as it drains from the work.

The water break test only determines whether or not oil, grease and fatty matter are present. This test has no value in determining the presence of oxides, carbon smut or inert matter.

The only time this test may be deceiving is following the use of a cleaner containing a high percentage of soap which has not been thoroughly rinsed, or if the rinse water is highly contaminated with a soap carryover. The presence of soap on a surface tested for the water break has a tendency to hold a solid film of water over a surface slightly oily. This is brought about by the wetting-out properties of soap solution. In this case work not chemically clean may be passed to the plating operation and rejections or peeling of the electroplate will result.

In preparation of metal for electroplating, the work must be chemically clean and pass the water break test.

Removal of Inert Matter and Insolubles from Metals Prior to Electroplating

Many complaints have been made on cleaners for which the cleaners are not to be condemned. No cleaner will do the impossible.

Many of these so-called complaints can be traced to the attempt to remove insolubles and inert matter which cannot be put into solution with any alkali cleaner.

Inerts and insolubles are classed as follows:

1. Carbon smut on cold-rolled steel.
2. Inerts in drawing and stamping compounds, such as white lead, french chalk, barium sulphate, lithopone, lime, etc.
3. Badly carbonized tempering and quenching oils.
4. Rust preventives which dry to a hard film.
5. Inerts of buffing compounds.

No. 1 and No. 2 can best be removed by hand washing with a solvent or in a spray-type washing machine.

No. 3 and No. 4 can best be removed by hand washing in a solvent.

No. 5 can be removed either by hand washing in a solvent or by violent agitation in a whale oil soap solution.

After these inerts and insolubles have been removed from the work, a chemically clean surface can be produced in a tank solution of the proper grade of cleaner.

Removal of Oxides in Preparation of Metals for Electroplating

Nearly all metals when exposed to normal atmosphere become oxidized. Ferrous metals are more subject to oxidation than non-ferrous metals.

Oxides on ferrous metals are referred to as rust and scale, while oxides on non-ferrous metals are called tarnish.

Oxides of metals should be completely removed prior to placing the metal in an electroplating bath to prevent contamination of the plating solution with metallic oxides and to insure a uniformly colored surface on which to electroplate. Spots of tarnish on work show through the electroplate.

Since plating solutions are reducing agents for oxides, these oxides rapidly go into the plating solution in the form of metallic salts. The addition of these metallic salts soon would throw the chemical composition of the plating solution out of balance.

Oxides or rust and scale on ferrous metals are removed in a pickling solution of three to five per cent of either sulphuric or muriatic acid. The temperature may be from room temperature to 140° F. (60° C.). Hot pickling solutions speed the pickling operation.

Oxides or tarnish on non-ferrous metals are usually removed by dipping the metal in solutions of either sodium cyanide or potassium cyanide. The concentration may vary from one-half ounce per gallon to eight ounces per gallon, in accordance with the class of work. This operation is called a cyanide dip and is always done in a cold solution.

*Prepared by the technical staff of E. F. Houghton & Company, Philadelphia, Pa. Part 1 was published in our September issue.

Correction

In the first instalment of this article, page 359-360, September, 1932, under the section "Aluminum and Its Alloys," the first sentence of the first paragraph should have read: "'Controlled' alkalies are frequently used in the composition of cleaners for non-ferrous metals, and are the only types of alkalies that can be used on aluminum or its alloys."—Ed.

If the tarnish or oxidation on non-ferrous metal is excessive and cannot be removed in a cyanide dip, then a bright dip solution is necessary. A formula for bright dip for brass is:

Sulphuric acid	1 gal.
Nitric acid	1 gal.
Muriatic acid	1 qt.
Water	1 pt.

Many variations of this formula are used to produce desired results on non-ferrous metals of different analyses.

The chemicals above mentioned for oxide removal are not effective cleaners for the removal of oil, grease and fat, and are greatly weakened if contaminated by oil or grease.

If oil, grease and fat are not completely and uniformly removed from work prior to pickling, cyanide dip or bright dip, the portion of the work which is chemically clean is attacked, whereas the portion of the surface covered with oil, grease or fat is not attacked. This results in etching of the portion which was chemically clean and non-removal of oxides from the portion which was not chemically clean. Peeling of the electrodeposit or non-uniformity of color of the electroplate is unavoidable on such work.

Work should always be rinsed after cleaning prior to pickling, cyanide dips and bright dips, and a rinse should follow these operations. If pickled work is plated in an alkali plating solution, the procedure is clean, rinse, pickle, rinse, neutralize, rinse and then electroplate.

Rinsing of Metals Between Operations

Rinsing is done in tanks of either hot or cold water. The film of solution from the preceding operation is diluted in the rinse water to such an extent that any remaining traces are so weak that they will not interfere with the succeeding operation.

The ready solubility in water of the various chemicals used in the process of preparing metals for electroplating determines the rinsing qualities of these chemicals.

All rinse tanks should be kept overflowing and as clean as possible. If rinse water becomes built up with either alkali or acids from a preceding operation, their power of dilution is reduced in proportion to the contamination.

Alkalies should be rinsed prior to acid baths to prevent neutralization and change of the chemical composition of the acid bath.

Acids should be rinsed prior to alkali baths to prevent neutralization and change of the chemical composition of the alkali bath.

Alkalies should also be rinsed prior to subsequent alkali baths to prevent change in the chemical composition of the subsequent bath.

Work should **not be allowed to dry** in atmosphere between operations in preparation of metals for electroplating. In the event of a tie-up in production, work should be kept in a cold rinse tank until placed in succeeding operation.

Rust quickly forms on chemically clean ferrous metal if exposed to atmosphere. Tarnish quickly forms on chemically clean non-ferrous metal on exposure to atmosphere.

Thorough rinsing between operations is a vital factor in producing good electroplating. A separate rinse is provided after each acid or alkali bath.

Acid and Alkali Plating Solutions

When you are familiar with the operations of cleaning, rinsing and oxide removal and know whether acid or alkali was used for oxide removal you can then determine the proper rinse to use between oxide removal and entering either an acid or an alkali plating solution.

The following is a listing of the various plating solutions classified as acid and alkali solutions.

ALKALI PLATING SOLUTIONS	ACID PLATING SOLUTIONS
Brass	Chromium
Bronze	Nickel
Cyanide Copper (Fine soft deposit)	Acid Copper (Coarse, brittle and hard deposit)
Zinc	Zinc (least expensive and preferable)
Lead (For heavy deposits)	Lead (For light deposits)
Tin	
Iron	
Silver	
Gold	

This series will be concluded in an early issue.—Ed.

The Properties of Commercial Varieties of Copper at High Temperatures

By T. G. Bamford*

THE object of the research was to throw further light upon the service properties of commercial copper at elevated temperatures. It was also desired to obtain information regarding the existence of a temperature range in which certain coppers were supposed to be brittle. Five typical commercial coppers were examined. All these varieties were shown to be capable of resisting shock extremely well up to 400° C. and with one exception—that of tough-pitch arsenical copper—impact strength was well maintained up to 600° C. Although at no temperature could any sample be said to be brittle, yet under alternating stresses exceeding the endurance limit it was found that at certain temperatures the metal developed reduced resistance to such stresses. In general nickel-copper has the greatest, and tough-pitch pure copper the least capacity for withstanding alternating stresses at elevated temperatures, although the capacity varies considerably from one temperature to another. Nickel-copper has exceptionally high endurance at a temperature of 560° C. The author concludes that evidently it is important to exercise considerable care in regard to the use to which the metal is to be put when specifying its composition.

*Abstract of a paper read at the meeting of the British Institute of Metals, London, England, September 12-15, 1932. (See page 393 of this issue.)

Analysis of Free Cyanide in Brass Plating Baths

By L. C. PAN

Instructor in Electroplating, the College of the City of New York, and Technical Director, United States Research Corporation, Long Island City, N. Y.

A Check-Up of the Four Methods of Analysis Now in Use, and Comparisons of Their Value

FREE cyanide in brass plating solutions is that part of sodium cyanide in excess of the minimum amount required to keep copper and zinc in solution.[1] It is important because it affects the anode and cathode efficiency, anode polarization throwing power and conductivity of the solution, and it controls the composition, color, texture and ductility of deposit. The usual way of determining the amount of free cyanide present in a plating solution is the Liebig method, titrating against a standard silver nitrate reagent until AgCN precipitate is visible in the mixture. This method has been improved by Sharwood,[2] Clennel,[3] Wick,[4] Thompson[5] and others, but none of the methods or modifications of them was studied with specific reference to brass plating solutions. Hogaboom[6] found that carbonate in brass solutions interferes with free cyanide determination by the Liebig method, and used barium nitrate to precipitate out carbonate before the titration with silver nitrate. Sanigar[7] found difficulty in completely removing barium carbonate precipitate from the solution and recommended greater dilution during titration. Blum[8] suggested titration with standard iodine reagent for free cyanide of cyanide copper solutions. This method is inapplicable to brass solutions, as the writer has found iodine reacts with combined cyanide also.

The difficulties surrounding the free cyanide determination for brass solutions are mostly due to the presence of both copper and zinc in the solution. Copper is noted to form various complex cyanides such as $NaCu(CN)_2$, $Na_2Cu(CN)_3$, $Na_3Cu(CN)_4$, etc., which would make the free cyanide indeterminate. There is also some uncertainty about the complex zinc cyanides, $NaZn(CN)_3$ and $Na_2Zn(CN)_4$, although textbooks on electroplating invariably give $Na_2Zn(CN)_4$ as the compound in brass solutions.[9] Zinc interferes with free cyanide determination by the Liebig method, giving higher results.[10, 11] Zinc complex cyanide hydrolizes during the titration into sodium zincate and gives more free cyanide.

$$NaZn(CN)_3 + NaCN + 2H_2O \rightleftharpoons Na_2ZnO_2 + 4HCN$$

Ammonia either purposely added to the brass plating solution as a brightener, or formed in the bath through decomposition of cyanide, interferes with titration using silver nitrate, giving higher results.

Even if all the interfering elements could be eliminated or taken care of, there is still the effect of dilution. We can never analyze a sample of solution volumetrically and retain the original volume, and yet the free cyanide content after dilution may be totally different from that in the original solution. With all these problems involved in the free cyanide of brass plating solutions, the following account of some of the experiments conducted by the writer may be helpful in clearing up a few points on the subject.

In a paper recently presented at the Philadelphia Convention of American Electroplaters' Society,[12] the writer has demonstrated that the free cyanide in a brass plating solution is the excess sodium cyanide above what is required by copper and zinc cyanide to form $Na_2Cu(CN)_3$ and $NaZn(CN)_3$, but not $NaCu(CN)_2$ or $Na_2Zn(CN)_4$.

To determine this free cyanide in brass plating solutions, the following four methods of analysis were studied and compared with respect to accuracy, reliability and ease of manipulation:

(1) The Liebig method of silver nitrate titration.

(2) Silver nitrate titration with small amount of potassium iodide as indicator.

(3) Silver nitrate titration with large amount of potassium iodide as indicator.

(4) Titration against standard copper sulfate solution.

Liebig Method for Free Cyanide Determination

The original Liebig method for free cyanide determination is to titrate the cyanide solution with silver nitrate reagent, using no indicator whatsoever, until a permanent turbidity develops in the mixture. This method

[1] Blum, W. "The Definition of Free Cyanide in Electroplating Solutions," Transactions of Electro Chemical Society, *60*, 143 (1931).

[2] Sharwood, W. J. "Notes on the Estimation of Cyanogen by Silver Nitrate, Using Potassium Iodide and Ammonia as Indicators," Journal of American Chemical Society. *19*, 400 (1897).

[3] Clennel, J. E. "Cyanide Handbook" (McGraw Hill Company), p. *512* (1915).

[4] Wick, R. M. "Analysis of Silver Plating Solutions." Monthly Review, American Electroplaters' Society, *17*, 14 (Dec., 1930).

[5] Thompson, M. R. "The Titration of Free Cyanide in Copper Baths," Monthly Review, American Electroplaters' Society, *18*, 31 (May 1, 1931).

[6] Hogaboom, G. B. "Brass Plating," Souvenir Book, the Philadelphia branch of American Electroplaters' Society, pp. *58-76* (1929).

[7] Sanigar, E. B. "The Titration of Potassium Cyanide and Free Cyanide in Silver Plating Solutions by Means of Silver Nitrate," Transactions of Electro Chemical Society, *58*, 435 (1930).

[8] Blum, loc. cit.

[9] Blum, W., and E. B Hogaboom. "Principles of Electroplating" (McGraw Hill Company), p. *384* (1930).

Langbein, G. "Electro Deposition of Metals." (Henry Carey Bairs Co.), p. *838* (1929).

Allmand, A. J. "Principles of Applied Electro Chemistry" (Edward Arnold) p. *313* (1912).

[10] Sharwood, W. J. Loc. cit.

[11] Blum, W., F. J. Liscomb and C. M. Carson. Zinc Cyanide Plating Solutions, U. S. Bureau of Standards, Technologic Paper 195, p. *4* (1921).

[12] Pan, L. C. "Free Cyanide in Brass Plating Baths." Proceedings of the 20th annual convention, American Electroplaters Society, Philadelphia, June 20, 1932.

is interfered with by the presence of carbonate, zinc, ammonia Ferro-cyanide and dilution. In this study the question of **dilution** was taken up first.

Using a standard brass solution of the following composition:

	g./l.	oz./gal.
Copper cyanide	31.5	4.2
Zinc cyanide	11.5	1.5
Sodium cyanide	50.5	6.7
Sodium carbonate	30.0	4.0

Free cyanide was determined by a direct titration with 0.1005 N. silver nitrate reagent after the addition of various amounts of water to the sample, so that the total volume ranges from 25 to 105 ml. The results of this series of experiments, as shown in Figure 1, indicate that

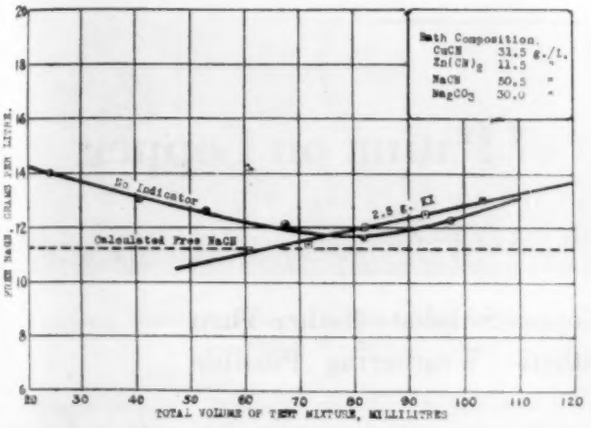


Fig. 1. The Effect of Dilution Upon Free Cyanide Test for Brass Solutions.

dilution first lowers, then raises the free cyanide value by this method of analysis with a minimum at 80 ml. The first part of the curve is unusual and contrary to more common findings that dilution would make the results higher. At greater dilutions, the apparently high free cyanide content may be due to the solubility of the silver cyanide in such a mixture. Within the limits of 70 to 90 ml., however, the effect of dilution on analysis of the free cyanide is small enough to be within experimental error.

Comparing these results with the calculated free cyanide content on the basis of $Na_2Cu(CN)_3$ and $NaZn(CN)_3$ as the complexes, it is evident that only at an optimum dilution the results of titration truly represent the free cyanide in the original solution. Such optimum dilutions will vary with the composition of the brass solution and the volume taken for titration. Under conditions similar to those used in this study, a dilution of 8 (or 80 ml. at the end of titration on a 10 ml sample) gives best results.

The effect of **carbonate** upon the Liebig method as applied to the free cyanide in brass solutions, was reported by Hogaboom,[13] who states that the results were not reproducible, while Sanigar[14] found with his silver plating solution that carbonate formed with silver nitrate a difficultly soluble silver carbonate, which, if precautions were not taken, interfered with the end-point. Neither of these effects was noticed by the writer in the present study of brass plating solutions. Those effects which were observed by the writer were of a different nature.

[13]Hogaboom, loc. cit.
[14]Sanigar, loc. cit.

In general, the effect of **carbonate** upon the accuracy of the Liebig method for free cyanide is small. In most cases the presence of carbonate gives slightly higher results of free cyanide, unless the carbonate content should be very low (Fig. 2). All this indicates that the sodium carbonate has some solvent action upon silver cyanide; the solubility does not, however, increase with the concentration of carbonate, therefore increasing carbonate content beyond 25 g./L. produces no further effect on

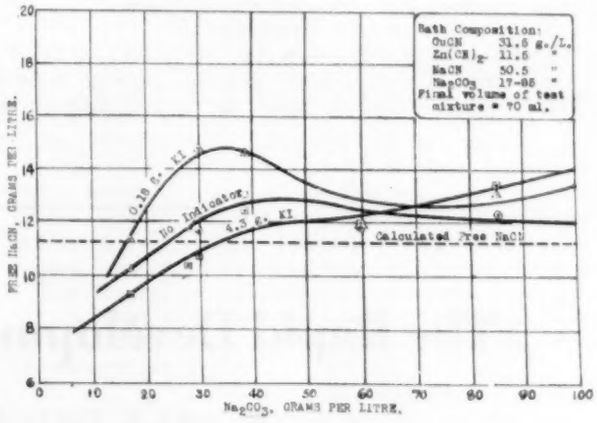


Fig. 2. The Effect of Carbonate Upon the Free Cyanide Test for Brass Plating Solutions.

the silver nitrate titration for free cyanide. With various concentrations of sodium carbonate from 17 to 85 g./L. in a standard brass solution as given above, the end-point of titration is not at all affected according to the results of this study.

The interference of zinc with free cyanide determination by the Liebig method was observed by Clennel and Blum, Liscom and Carson.[15] These authors, however, did not work with brass plating solutions. In the present study the effect of zinc upon free cyanide determination was tested by using brass solutions containing various zinc cyanide contents (from 4 to 22 g./L.) but with same free cyanide content. The results by silver nitrate titration (with no indicator) are surprisingly close to the calculated values of free cyanide (Fig. 3). It shows definitely that zinc in brass solutions does not interfere with the free cyanide determination by the Liebig method.

Both Sharwood and Clennel recommended the use of potassium iodide and **ammonia** as indicators for the determination of free cyanide in cyanide solutions.

[15]Loc. cit.

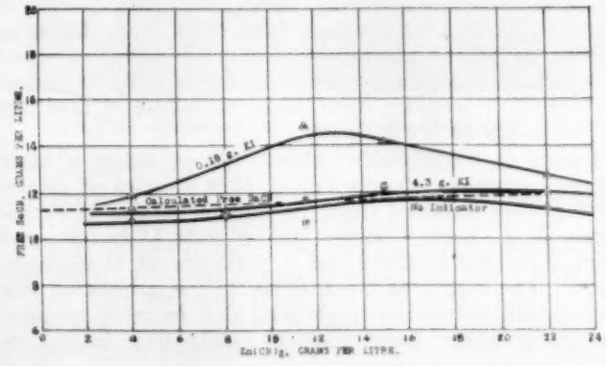


Fig. 3. The Effect of Zinc Upon the Free Cyanide Test for Brass Plating Solutions.

Whether or not ammonia improves the sharpness of the end-point in titration, the writer found that adding ammonia directly to the brass solution for titration causes erratic results of free cyanide. By a careful study, the effect of ammonia amounts to an apparent increase of free cyanide content of 0.04 g./L. for every ml. of concentrated ammonia water in a liter of brass solution (Fig. 4). The reason for the higher results when ammonia is present is obvious, that some of the silver nitrate which is added to the mixture formed with the ammonia a soluble silver-ammonium complex compound:

$$AgNO_3 + 2NH_4OH \longrightarrow Ag(NH_3)_2NO_3 + 2H_20$$

Since there is always some ammonia present in brass solutions, either purposely added or formed through the decomposition of sodium cyanide, it seems that the chief objection of using the original Liebig method for the free cyanide determination in brass solutions is this interference of ammonia and not dilution, nor the presence of carbonates. It is quite impossible to keep the brass solution free from ammonia, as the latter is continuously formed in such a solution when electrolysis is going on. Furthermore, because ammonia is a very good brightener for brass plating solutions, we will have to deal with this substance, even though it interferes with the free cyanide determination. The fact that it is quite difficult to determine the amount of ammonia present in the brass solution further complicates things, as no accurate correction could be made on the results of an analysis.

This article will be completed in an early issue.—Ed.

The Rapid Development of Patina on Copper

By JOHN H. FREEMAN, JR. and P. H. KIRBY*

Discovery That Patina Is a Basic Copper Sulphate Rather Than Carbonate Makes Improved Synthetic Weathering Possible

COPPER has been used for centuries in building construction, one of the principal earlier uses being for the domes of cathedrals and monumental structures in all parts of the world. The green patina, that develops through natural weathering on the exposed surfaces of copper, was greatly admired by architects of early days and tradition tells of various unusual methods used to accelerate its formation. None of these was successful. Now after years of work a process has been developed by means of which copper and certain copper alloys may be given an adherent green surface coloring, which is practically identical in composition and appearance with the patina that forms on copper surfaces after a period of years when exposed to the atmosphere. The process must at present be applied to copper shapes before installation. These synthetic patinas are believed to be permanently resistant to weathering. To date specimens exposed to a severe industrial atmosphere for a period of over six months during which time they were wet down by heavy showers four times daily, have shown no change or lack of adherence. Similar specimens exposed to a strictly marine atmosphere for five months, including severe winter weather, have shown no failure or tendency of the patina to break down.

Patina is traditionally referred to as being a basic copper carbonate. In the fall of 1928 samples of copper roofing were removed from the railroad station at Providence, R. I., from Woolsey Hall at Yale University and from a factory building and a residence at Waterbury, Conn. The results of the analyses of the patinas on this copper were surprising in showing that in every instance the patina was a basic sulphate rather than basic carbonate. Independent studies made at about the same time had revealed that the patina on copper roofs on some of the oldest structures in England was also basic sulphate, being convincing proof that all reported methods of reproducing natural patina by accelerated means were based undoubtedly on a false premise.

An extensive study was made of the action of copper in various synthetic atmospheres of known carbon dioxide, oxygen, air and moisture contents under various conditions of concentration, temperature and pressure. These studies showed that basic sulphate patinas could be used to form on the surface of copper when exposed to an atmosphere of sulphur dioxide in the presence of moisture, but sufficiently consistent results could not be obtained within reasonable periods of time.

The patina thus produced lacked suitable adherence. In the experimental work that followed electrolytic methods were employed but not completely developed in view of more promising results obtained by an ammonium sulphate process. It was found that copper exposed to a spray of ammonium sulphate solution for about 24 hours acquired a dark green adherent patina. Alternate immersions in the solutions resulted similarly. A continuous immersion would not produce results, indicating that the formation of the patina was intimately associated with an oxidizing action of the atmosphere combined with the ammonium sulphate attack.

Based on these discoveries the commercially practical process described in the article was worked out. The patina may be applied in about 24 hours as compared to the 12 to 14 years required by natural weathering. The color of the patina on completion is a dark blue-green. It is relatively permanent in industrial atmospheres but changes gradually on exposure to the lighter natural shade. In marine atmospheres the change is more rapid.

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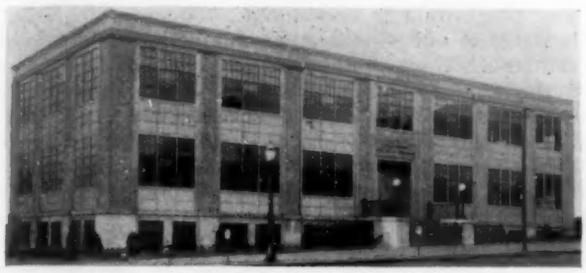
* Summary of an article appearing in the September, 1932, issue of "Metals and Alloys."

Aluminum's Uses Range from Furniture To Complete Buildings

All-Metal Office Building

STEADILY pursuing a program of development of new applications for its products, the aluminum industry prides itself today on the fact that the metal, in the pure or alloyed forms, is being used for a variety of purposes ranging from the familiar multitude of small gadgets, fixtures and appliances, to furniture, mechanical parts and devices of large size, and even the sheathing of complete buildings.



Aluminum Sheathed Office of the Richmond Department of Public Works.

The first all-metal office building erected in this country is the new home of the Richmond, Va., Department of Public Works, shown in the accompanying picture. It has inner and outer walls of plate and sheet aluminum, with aluminum in extruded shapes between the layers. Considerable interior work of aluminum alloy, finished in a variety of styles, is also embodied in this building. Finishes on the exterior were produced by sandblasting the pilasters and entablatures, and applying a satin aluminum finish to the light metal areas, thus producing a nice contrast. Black paint was applied to window frames. Interior partitions are of satin finished sheets of aluminum.

The saving in weight resulting from the use of aluminum curtain walls is impressive, as a decided reduction is achieved in thickness as well as weight of the walls. Facades from 3½ to 7 in. thick average less than 10 lb. per square foot. For comparison the concrete walls of the basement are 10 in. thick and weigh about 120 lb. per square foot. Tests have shown that double metal walls of the type used have an insulating value equal to that of a 48-in. brick wall.

Simplicity and ease in assembling the metal forms greatly reduced the time required for construction, the building being completed in four and one-half months. The cost definitely shows the economies resulting from the use of metal, according to James Bolton, chief of the Richmond Bureau of Surveys. The building has a cubical content of 222,244 cu. ft. Without such accessories as partitions, floor coverings, window shades, and the like, the cost of construction was 19.1c. per cubic foot; with these accessories the cost was 22c.

Aluminum Furniture

A NEW market for aluminum furniture was opened recently when Otto K. Eitel, general manager of the New Bismarck Hotel, Chicago, Ill., and a leading figure in the hotel field of the country, made a purchase of eight armchairs, 16 straight backed chairs and a telephone table, all of aluminum alloy. This purchase is said to be the first of its kind by a hotel in metropolitan Chicago. The equipment was installed in the Vienna room of the hotel as part of its general renovation.

The frames of the chairs are aluminum in color, and the upholstering is done in a wine-red shade. In harmony with the furniture, aluminum toned lighting fixtures light the room indirectly.

Aluminum Foil Insulation

A DISTINCTLY new use for aluminum has been found in the application of the metal in the form of foil to the insulation of houses and buildings.

According to the current issue of "American Builder," the foil is applied to building paper of the ordinary kind. When such foil covered paper is applied to the insides of house walls with the foil facing the space between the inner and outer wall layers, it is said by engineers to be equivalent to a half inch of ordinary insulation. Its ease of application and economy are stressed as being in its favor, and a considerable use of aluminum foil for this purpose is anticipated.

Aluminum Furniture in the Vienna Room of the New Bismarck Hotel, Chicago.

Foil wrapping for steam pipes and other piping which requires insulation has also been tested. It was reported some time ago that aluminum foil steam pipe insulation had been found highly efficient, a very thin layer of foil equalling a layer of the ordinary asbestos of the usual thickness.

Editorial Contents and particulars on advertising page 4 (before text); Buyers' Guide on advertising page 40 (after text pages).

EDITORIALS

Rebuild Business for Profit

A NEW national movement has been started, having its inception in Washington. A. W. Robertson, chairman of the Westinghouse Electric and Manufacturing Company, has been appointed chairman of President Hoover's Committee of Industrial Rehabilitation. It is the work of his Committee to attempt to revive the nation's business in the field of heavy equipment which calls for capital investment. His country-wide organization of business leaders is bluntly asking heads of concerns everywhere to do two things.

1. To restock their plants to the extent that it will improve operation without necessarily increasing productive capacity; to replace obsolete, worn-out equipment with modern and up-to-date tools and machinery, which will enable them to manufacture at the lowest possible cost.

2. To put pressure on their own sales, using advertising as an important force so as to get the maximum direct benefit out of this Winter's buying.

Two points stand out in the plan of the Robertson Committee.

1. The advice offered above is not given merely to improve general business. It is urged, in the interest of the individual manufacturer, to buy now, primarily for his own advantage and not only for the "general good."

2. The efforts of the Committee are centered only on businesses, big or little, that are solvent, able to buy and able to pay their bills.

The proposition is very simple. A surprisingly large proportion of our solvent and going concerns have plants which have become at least partially obsolete. In order to manufacture at a profit, and in some cases in order to survive at all, they must put themselves in a position to sell at the lowest possible prices, in keeping with the times. There is only one way in which this end can be accomplished—by employing the last word in up-to-date and labor-saving machinery. Even though times are beginning to improve, they will improve only for those who are able to show a profit at the most competitive prices. These prices are impossible to meet without the most modern facilities.

Moreover, it seems that now is the time to buy. Prices have begun to rise, plants are still operating at reduced rates and revamping can be effected without impeding production. Business credit is easier than it has been in the past two years, through the effect of the Reconstruction Finance Corporation's activities and the freer policies of the Federal Reserve Bank.

The Robertson Committee, operating as it does in a field which everyone knows suffers first and recovers last, deserves and has the good wishes of all American business. The strongest point in its favor is that it is not urging charity or vague general altruism. Its foundation is enlightened self-interest as clearly expressed in its slogan "Rebuild Business for Profit."

Why Some Companies are Profitable in Bad Times

THROUGHOUT the worst of the depression it has been a significant fact that a number of corporations have been and are continuing to earn profits. Why is it that some businesses are able to stay out of the red when the great bulk are in over their heads?

An interesting analysis of this situation has been written by John A. Murphy of the G. M. Basford Company. To his mind his secret of making money during a depression is "to place your business in tune with conditions," in other words, to readjust to new economic conditions. The means used are listed as follows.

1. The introduction of new products.
2. Using new selling methods.
3. Making fundamental changes in the basis of the business.

The first method is not a new one, but as everyone knows it is to say the least, dangerous during bad times. It would be very important information if we could get a figure showing the number of new products placed on the market in bad times and the percentage of this number which have been successful. It is our impression that the statistical evidence would be decidedly against any venture. Yet, undoubtedly, many do succeed.

"Using new selling methods" is a little vague. Does it mean higher pressure? Does it mean lower prices as the primary selling point? There have been cases where both of these methods have been successful. Undoubtedly lowered prices are an indispensable and irresistible sales aid when business is slow.

"Fundamental changes" is such a wide term that it is hard to analyze. It may mean a complete change in line of products, it may mean a change in capital structure. It may mean anything.

Obviously, when times are bad all business must take thought and change its step to suit the conditions surrounding it. The first and probably the most important

step to take is the one most often neglected, and that is to obtain reliable, accurate and complete market information. This may be done through reports from salesmen. It may be done through communication with its customers. It may have to be done through a special market survey. But under no circumstances should this step be neglected, as without it conclusions are nothing more than guesswork, and steps taken may be in the direction diametrically opposed to the right one.

Metal Fatigue

IT IS not so long ago that it was the practice of repair men to look at a piece of metal that had been broken in use, turn the fracture toward the light and say "The metal is crystallized." Thus the word "crystallized" became synonymous with "brittle" and "lifeless." Later the word "fatigue" came into use.

We know now that the use of the word "crystallized" in this connection, was erroneous. Under the microscope, it was discovered that metals are always crystalline, so we have had to look for other reasons for the failure of metals under stress, either sudden as in shock, or repeated as in ordinary use for a long period of time. It was found also, that under repeated stress the crystals in metals were broken up into thin plates which slid over each other, and this sliding developed into cracking.

The study of the "fatigue" of metals has grown to be one of the most important parts of the work of metallurgical and testing laboratories. Fatigue tests are difficult to carry out conveniently because of the long time necessary to complete them. It has been shown in a general way, however, that tensile strength has a closer relation to fatigue strength than any other physical property, but this correlation is not close enough to be used as an accurate index. Moreover, it has been found that chemical action greatly increases the susceptibility of metal to failure under repeated stress, especially if the corrosive liquid is applied at the same time as the stress.

According to Dr. H. F. Moore of the University of Illinois, fatigue failure is essentially failure by a spreading crack. The use of the X-ray spectrograph and the work of numerous investigators on single crystals has shown that slipping action in metals follows definite atomic planes within a crystal, and it is only because of the interference between the many differently oriented crystalline grains in a piece of metal that such slipping does not occur at very low stresses. It is as yet unknown, however, just when and how the first cracks start in metal under stress.

It is largely from fundamental research work of this kind that the development of radically improved alloys will spring, in the future.

Metallic Coatings on Steel

ALTHOUGH no accurate statistics exist on the subject, it is probable that metallic coatings are used to a greater extent on steel than on any other metal. The reasons are obvious: (1) to enhance its appearance; (2) to resist corrosion; (3) to resist wear. M. J. Udy gives a good summary of their place in the industrial scheme in a recent article in Mining and Metallurgy.

The metal coatings used for improvement of appearance are largely applied by electroplating. Nickel, silver, copper in its various color effects and chromium are generally used in common practice. Cadmium, zinc and tin are more important for protection against corrosion. However, combinations of copper, nickel and chromium are also used for this purpose with excellent results.

It is now a well known fact that the protection against corrosion depends not only upon the metal used for the coating but also upon the care with which the coating is applied. It must be free from pinholes and other defects. Zinc and cadmium, however, being positive to iron, have in themselves the power of protecting it, and a little more leeway is allowable, as a fair measure of protection can be obtained with even an imperfect coating. Needless to say, however, the perfect coating is far more effective.

The advent of chromium plating increased the general use of electroplating more than perhaps any other single factor in recent years, because it extended the field beyond decoration, to wear resistance, for which electroplating had never before been suitable. Chromium has a very low coefficeient of friction and is also very hard, thus offering great resistance to frictional wear especially.

It must be borne in mind that resistance to abrasion is in a different class from ordinary resistance to wear, being much more severe. It is a fact also that no metallic coating can be made resistant to both abrasion and corrosion. Corrosion resistance is effected by the formation of a film. Abrasion removes this film and consequently leaves the metal open to further corrosion.

One of the most important factors in applying a "perfect" electroplated coating to steel is the quality of the base metal. It is a fact that poor steel, pitted, dirty and with slag inclusions, cannot possibly be put in shape to take a perfectly homogeneous, adherent coating. Hot dipping, as used in the case of zinc and lead, will take better on low grade material than electroplating. Imperfect steel can sometimes be used, however, by first depositing on it a soft undercoating like copper, heavy enough so that it can be buffed over and flow into the pits and scratches, leaving a perfect surface on top. On this coat can be deposited a harder metal such as nickel, and this followed by chromium, offers a very high grade resistant electroplated metal coating. As a matter of fact this procedure is standard in finishes for many automobile parts.

It must be remembered also that in addition to the proper practice in plating, the procedure of cleaning before plating cannot be neglected in the slightest detail. Every part of the metal to be plated must be chemically clean. There is no way of eliminating this step or of making it less rigid.

Safety in the Small Plant

A STARTLING disclosure was made recently by officials of the Labor Department of New Jersey in connection with their special appeal to small industrial plants to enter the Fifth Annual State-Wide Interplant Safety Contest, to be held from October to December 1932. They observe that the accident frequency of the small plant is higher than that of large organizations. For that reason they are especially interested in having small companies enter their safety contest.

A broad statement of this sort might be questioned if it did not come from such a reliable source. It is without question a severe indictment of the small factory. The large plant cannot improve its practices without spending money. The small plant can raise its standards by the expenditure of greater effort, because of the possibility of closer supervision by its heads. If the small plant is less safe than the big one, it is because its owners do not try so hard to prevent accidents.

We commend this contest to the attention of our readers in New Jersey.

Shop Problems

This Department Will Answer Questions Relating to Shop Practice.

ASSOCIATE EDITORS

Metallurgical, Foundry, Rolling Mill, Mechanical

H. M. ST. JOHN W. J. PETTIS
W. J. REARDON P. W. BLAIR

Electroplating, Polishing, and Metal Finishing

O. J. SIZELOVE A. K. GRAHAM, Ph.D.
G. B. HOGABOOM WALTER FRAINE

Black for Toy Pistols

Q.—We are manufacturers of toy paper cap pistols, and heretofore have been finishing all of our pistols with a nickel plate. We are now desirous of finishing our pistols, which, of course, are made of cast iron, in a black finish somewhat simulating the black finish found on high grade revolvers.

Will you be good enough to outline for us just how an inexpensive black finish may be obtained?

A.—There is no chemical method we know of that you could use to produce a black finish on the cast iron work. The finish that is produced upon high grade revolvers is a combination chemical and heat treatment method, and besides being too costly, it would not work satisfactorily on cast iron.

We have two methods in mind that you could probably use. One is the use of a black lacquer enamel which could be applied by dipping and would be quite cheap. The other is to copper plate the work, then blacken in a sulfur solution, scratchbrush, and lacquer. O. J. S., Problem 5,132.

Black on Aluminum

Q.—We have a small aluminum part that we desire to lacquer or enamel in a dead color and either bake or process to make it lasting.

Can you tell us what to use and how?

A.—If you desire to produce an enamel finish on aluminum we would suggest the use of a synthetic lacquer enamel. This material gives better results than cellulose lacquer enamels. It requires a baking temperature of 300° F., and if you will consult the "Buyers' Guide" pages you will find lacquer manufacturers who will be glad to submit samples of their products to you.

There is also a process, that is used to produce different colors on aluminum, known as the "Alumilite" process. This process is controlled by the Aluminum Colors, Inc., of Indianapolis, Ind., and we suggest, if you are interested, that you write to them. O. J. S., Problem 5,133.

Uniform Bronze Finish

Q.—I want to know how to put a uniform bronze finish on bronze doors for office buildings. I use solutions of potassium sulfate and of acid. I find it very hard to blend in the oxidizing with either sand or pumice stone. Could you advise a better procedure?

A.—It is a difficult job to produce an even color on large work such as you are doing. It is best to make the finish considerably darker than is desired with the oxidizing solution, and then depend on the brushing operation to even the finish and produce the desired shade of color.

While sand or pumice and a bristle brush are generally used to even the finish, steel wool can also be used with or without the pumice or sand. O. J. S., Problem 5,134.

USE THIS BLANK FOR SOLUTION ANALYSIS INFORMATION

Fill in all blanks if possible.

Date .....

Name and address: .....**Employed by:** .....

Kind of solution: .....**Volume used:** .....

Tank length: .....**width:** .....**Solution depth:** .....

Anode surface, sq. ft.: .....**Cathode surface, sq. ft.:** .....

Distance between anode and cathode: .....**Kind of anodes:** .....

Class of work being plated: .....**Original formula of solution:** .....

REMARKS: Describe trouble completely. Give cleaning methods employed. Send small sample of work showing defect if possible. Use separate sheet if necessary.

NOTE: Before taking sample of solution, bring it to proper operating level with water; stir thoroughly; take sample in 2 or 3 oz. clean bottle; label bottle with name of solution and name of sender. PACK IT PROPERLY and mail it to METAL INDUSTRY, 116 John Street, New York City.

Bright Dipping Brass

Q.—Is there a good bright dip for brass such as the sample we are sending you? The discoloration is printing ink. Much of the work is dirtier than this sample.

A.—Would recommend that the following procedure be used in bright dipping the class of work such as sample submitted.

Wash in gasoline or kerosene to remove the printing ink. Then soak in a hot alkaline cleaning solution for a few minutes so that the work is thoroughly clean. Then place in a "burn off" dip for a few seconds; rinse in cold water; bright dip; rinse in cold water; dip in cyanide dip; rinse in cold water; rinse in hot water; dry in clean hardwood sawdust.

In making the "burn off" dip use two parts of sulfuric acid, one part of nitric acid, and five parts of water. This dip is used hot.

The bright dip is made of sulfuric acid, two gallons, nitric acid, one gallon, water, one quart. Use cold.

The cyanide dip is made by dissolving six oz. of sodium cyanide in one gallon of water.

O. J. S., Problem 5,135.

Ductile Nickel Deposit

Q.—We do electro-forming and have made up a solution of double nickel salt, 8 ounces, single nickel salt, 8 ounces, sodium chloride, 3 ounces, boric acid, 3 ounces, to one gallon of water.

The tank is an earthenware crock and contains 40 gallons of the above solution at 90 to 100° F., reading pH, 5.0.

We plate shells. These should be of a moderate flexibility and are approximately .008 to .010 inch thick. We obtain very good results in this 40 gallon crock.

We are now prepared to make these shells in quantity, and have prepared a wooden tank, pitch lined, with the same solution, containing 176 gallons, but do not obtain the same results. The shells come out hard and brittle. Is this due to the fact that we do not run it at a temperature of more than 85°? Has the temperature difference of from 80° to 100° so much to do with the pliability of the material?

In both tanks we use 99% and 97% anodes. The voltage used in both cases amounts to 2½ to 2 7/10 volts, giving us approximately .0005 inch deposit per hour.

For your examination we are sending you samples of the solutions, and three sample shells, two soft ones from the 40 gallon tank and the brittle one from the other tank.

A.—Analyses of nickel solutions:

No. 1	Metallic nickel	3.57 oz.
	Chlorides	5.72 oz.
	pH	5.8
No. 2	Metallic nickel	3.27 oz.
	Chlorides	5.38 oz.
	pH	5.8

While the analyses of the solutions do not conform to the formula that was used in preparing the solutions, they are similar enough to produce the same results if operated at the same temperature and current density. Temperature is quite a factor in producing a soft ductile deposit, and we would suggest that the solution be operated at 100 to 110° F. We would also suggest that you add to the 176 gallon solution one quart of 100 volume hydrogen peroxide, or its equivalent of the 30 volume variety. The addition of the hydrogen peroxide to the bath will also help produce a soft deposit.

O. J. S., Problem 5,136.

Hard Nickel

Q.—We have a nickel solution that is making a soft deposit on brass and iron pieces, and we want to fix it up so it will make the hard deposit on articles plated in this solution. Please tell us what is our trouble, and what chemicals we must add to get it right. The solution is made up of 12 oz. single nickel salts; 2 oz. nickel chloride; 1 oz. ammonium chloride; 2 oz. boracic acid; 2 oz. epsom salts.

It occurred to us that perhaps it is necessary to add sodium chloride or nickel fluoride; or perhaps we have used too much boracic acid.

A.—We can see no reason why a deposit from a solution made by the formula given should be too soft for the usual class of work. The trouble probably lies with the current density used, or else the pH of the solution needs adjustment.

We would suggest the use of a higher current density, and if this does not help, send us a sample of the solution for analysis. Also, send us a small sample of the work that has been plated in the solution.

O. J. S., Problem 5,137.

Nickel Analysis

Q.—I am enclosing under separate cover a small sample of nickel plating solution. I am interested in finding the chloride content, calculated as nickel chloride.

A.—Analysis of nickel solution:

Metallic nickel	1.89 oz.
Chlorides, as nickel chloride	6.97 oz.
pH	6.

O. J. S., Problem 5,138.

Silver Plating Installation

Q.—All of our equipment is installed except the silver plating tank, and we should like to have suggestions as to the right size tank for the work. We will do replating of such articles as cream pitchers, platters, table ware, etc., for jewelers and the general public.

Kindly advise us what kind of tank to install and give the proper dimensions. Also give composition of solution you think best for this work, and any other information you may have on the subject.

A.—It is a little difficult for us to tell you what size silver solution to install. It will depend upon the amount of work you will have to do. We might suggest that you start with a 50 gallon solution, and if this is not large enough, you can increase the size if the amount of work you do is too great for it.

A wood tank lined with pitch or asphaltum is generally used. Dimensions of tank: 36 inches long, 20 inches wide, and 24 inches deep. Use the following formula for the silver solution:

Silver cyanide	3½ oz.
Sodium cyanide	5 oz.
Sodium carbonate	2 oz.
Water	1 gallon

Use ¾ to 1 volt, with a current density of 4 to 5 amperes per square foot of work surface.

O. J. S., Problem 5,139.

Verde on Copper

Q.—Will you kindly send us information on producing verde antique effect on sheet copper?

A.—For an immersion green on copper the following solution will give good results:

Copper nitrate	16 oz.
Acetic acid	4 oz.
Water	1 gallon

The solution may be used either hot or cold, but if used hot it will work faster. On sheet work some difficulty may be encountered in producing an even finish; it may be necessary to stipple lightly.

Use an old painter's sash brush for this operation. Moisten the brush slightly with the solution and apply sparingly.

If the verde is to be applied by the stippling method only, use the following formula:

Copper nitrate	4 lb.
Ammonium chloride	4 lb.
Calcium chloride	4 lb.
Water	1 gallon

O. J. S., Problem 5,140

Patents

A Review of Current Patents of Interest

Printed copies of patents can be obtained for 10 cents each from the Commissioner of Patents, Washington, D. C.

1,859,919. May 24, 1932. **Recovery of Tin From Scrap Tin Plate and Like Tin Bearing Materials.** Mason George Gilbert, Port Elizabeth, South Africa, assignor to The African Tin Recovery Company Limited, Port Elizabeth, South Africa.

1,860,505. May 31, 1932. **Preparation of Surfaces for Coating.** Elmer M. Jones, Detroit, Mich., assignor to Parker Rust-Proof Company, Detroit, Mich.

1,860,524. May 31, 1932. **Manufacture of Lead and Zinc Alloys.** Jesse Oatman Betterton, Omaha, Nebr., assignor to American Smelting and Refining Company, New York, N. Y.

1,860,947. May 31, 1932. **Aluminum Alloy Casting and Process of Making the Same.** Aladar Pacz, Cleveland, Ohio, assignor of one-half to Aluminum Company of America, Pittsburgh, Pa.

1,861,272. May 31, 1932. **Method of Chromium Plating Crank Shafts.** Walter G. Hildorf and Hampson G. McIntosh, Lansing, Mich., assignors to Reo Motor Car Company, Lansing, Mich.

1,861,446. June 7, 1932. **Process of Electroplating.** Oscar L. Maag, Canton, Ohio, assignor to The Timken Roller Bearing Company, Canton, Ohio.

1,861,592. June 7, 1932. **Production of Castings of Magnesium and Magnesium Alloys in Permanent Molds.** Adolf Beck, Bitterfeld, Germany.

1,861,625. June 7, 1932. **Method of Producing Rare Metals by Electrolysis.** Frank H. Driggs, Bloomfield, and William C. Lilliendahl, Monclair, N. J., assignors to Westinghouse Lamp Company, a Corporation of Pennsylvania.

1,861,656. June 7, 1932. **Process for Producing Beryllium Metal.** Harry C. Claflin, Cleveland, Ohio, assignor to Beryllium Development Corporation, New York, N. Y.

1,861,798. June 7, 1932. **Method of Making Metallic Magnesium.** Ralph M. Hunter and Sheldon B. Heath, Midland, Mich., assignors to The Dow Chemical Company, Midland, Mich.

1,862,231. June 7, 1932. **Decorating Base Metals or Alloys of Base Metals.** James C. McFarland, Fort Thomas, Ky.

1,862,787. June 14, 1932. **Pouring Trough.** William T. Ennor, Massena, N. Y., assignor to Aluminum Company of America, Pittsburgh, Pa.

1,862,788. June 14, 1932. **Aluminum Alloy.** Earl McKinley Gingerich, Cleveland, Ohio, assignor to Aluminum Company of America, Pittsburgh, Pa.

1,863,221. June 14, 1932. **Method of Making Metallic Magnesium.** Sheldon B. Heath, Midland, Mich., assignor to The Dow Chemical Company, Midland, Mich.

1,863,419-20. June 14, 1932. **Refining of Copper.** Walter O. Snelling, Allentown, Pa.

1,863,429. June 14, 1932. **Bus Bar Joint.** Charles B. Willmore, Massena, N. Y., assignor to Aluminum Company of America, Pittsburgh, Pa.

1,863,612 and 1,863,645. June 21, 1932. **Chemically Resistant Silver Alloy.** Peter Assmann, Ludwigshafen-on-the-Rhine, Germany, assignor to I. G. Farbenindustrie Aktiengesellschaft, Frankfort-on-the-Main, Germany.

1,863,868. June 21, 1932. **Chromium Stripping Bath.** John F. McCullough, Detroit, Mich., assignor to Ternstedt Manufacturing Company, Detroit, Mich.

1,863,869. June 21, 1932. **Electroplating Bath.** John F. K. McCullough, Detroit, Mich., and Benjamin W. Gilchrist, East Orange, N. J., assignors to Ternstedt Manufacturing Company, Detroit, Mich.

1,863,935. June 21, 1932. **Mold for Nonferrous Castings.** Victor P. Schmidt and Harry A. Brenaman, Altoona, Pa.

1,864,013. June 21, 1932. **Process for Electrolytic Deposition of Metallic Chromium.** Dwight T. Ewing, East Lansing, Mich.

1,864,014. June 21, 1932. **Chromium Plating Process.** Dwight T. Ewing, East Lansing, Mich.

1,864,240. June 21, 1932. **Bearing Alloys.** Horace W. Gillett and Howard C. Cross, Columbus, Ohio.

1,864,777. June 28, 1932. **Recovery of Metals from Zinc Plant Residue.** Urlyn C. Tainton, St. Louis, Mo.

1,864,889. June 28, 1932. **Process and Products in the Art of Forming, Machining, and the Recovery of the Products Thereof, of Metals.** John L. Brown, Catonsville, and William W. Varney, Baltimore, Md.

1,865,082. June 28, 1932. **Pressure Indicator.** Horace Chrisman, Edgewood, Pa., assignor, by mesne assignments, to Pittsburgh Equitable Meter Company, Pittsburgh, Pa.

1,865,767. July 5, 1932. **Electroplating Equipment.** Martin Kirchner, Berlin-Lankwitz, Germany, assignor to United Chromium, Incorporated, New York, N. Y.

1,866,124. July 5, 1932. **Conveying Apparatus, Particularly for Electroplating.** Josua Oertli, Berlin-Charlottenburg, Germany, assignor to Siemens & Halske Aktiengesellschaft, Siemensstadt, near Berlin, Germany.

1,866,283. July 5, 1932. **Process of Electroplating Nonconductive Materials.** Paul R. Zinser, Chicago, Ill., assignor, by mesne assignments, to Woodall Industries, Incorporated, Detroit, Mich.

1,866,278. July 5, 1932. **Compound For Use in Casting Metals.** Benjamin F. Wallace, Brooklyn, N. Y.

1,866,699. July 12, 1932. **Brush for Electroplating and Electrocleaning and Anode for Use Therein.** Frederick Conlin, New York, N. Y.

1,866,701. July 12, 1932. **Method and Apparatus for Recovering Silver From Fixing Solutions.** Frank E. Garbutt and Thomas M. Ingman, Los Angeles, Calif., assignors to Eastman Kodak Company, a Corporation of New York.

1,866,879. July 12, 1932. **Rustproofing Material and Method of Treating the Same.** Van M. Darsey, Morenci, Mich., assignor to Parker Rust-Proof Company, Detroit, Mich.

1,867,111. July 12, 1932. **Bronze for Welding.** Harry L. Spence, Richmond, Va., assignor to H. L. Spence Company, a Corporation of Virginia.

1,867,527. July 12, 1932. **Process for Anodic Removal of Surface Metal Film.** Thomas E. Dunn, Bridgeport, Conn., assignor to Beryllium Development Bridgeport, Conn.

1,867,862. July 19, 1932. **Piston-Sand Core.** George L. Moore, Cleveland, Ohio, assignor to Aluminum Co. of America, Pittsburgh, Pa.

1,868,052. July 19, 1932. **Anode.** George Dubpernell, Ann Arbor, Mich., assignor to Udylite Process Company, Detroit, Mich.

1,868,293. July 19, 1932. **Alloys.** Joseph Kent Smith, Detroit, Mich., assignor to Berryllium Development Corporation, New York, N. Y.

1,868,320. July 19, 1932. **Electroplating Machine.** Albert H. Hannon, Springfield, Ohio.

1,868,420. July 19, 1932. **Light-Metal Piston.** Ludwig Kraemer, Cologne-Mannsfeld, Germany.

1,868,453-4-5-6-7. July 19, 1932. **Casting Easily Oxidizable Metals.** Robert T. Wood, Lakewood, Ohio, assignor, by mesne assignments, to Magnesium Development Corporation, a Corporation of Delaware.

1,868,499. July 26, 1932. **Process of Recovering Alumina from Silicious Materials Containing It.** William M. Guertler, Berlin, Germany, assignor to The Electric Smelting & Aluminum Company, Cleveland, Ohio.

1,868,545. July 26, 1932. **Tinning Machine.** John C. Slonneger, Milwaukee, Wis., assignor to International Harvester Company, a Corporation of New Jersey.

1,868,631. July 26, 1932. **Manufacture of Graphitic Compositions.** Russell Mervyn Doidge, Battersea, London, England, assignor to The Morgan Crucible Company Limited, Battersea, London, England.

Equipment

New and Useful Devices, Metals, Machinery and Supplies

Synthetic Drying Oil for Floor Protection, Etc.

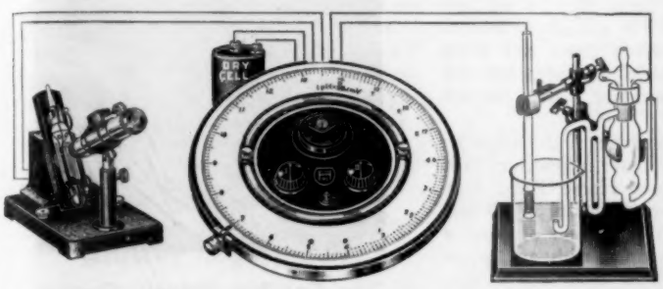
E. I. du Pont de Nemours and Company, Industrial Finishes Division, Parlin, N. J., offers "S. D. O.", synthetic drying oil, for use as a coating material, especially for protecting floors subject to chemical corrosion. The oil was discovered during the course of the company's research on synthetic rubber, and is said to have a number of highly advantageous properties in comparison with natural drying oils such as linseed oil. Its chief difference from the latter is that its drying or hardening is due chiefly to a chemical action called polymerization, rather than to absorption of oxygen from the air.

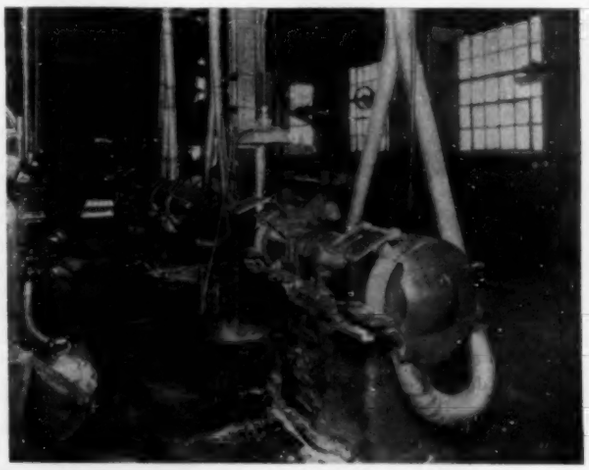
"S. D. O.," which is a patented product, in its pure state is a heavy-bodied, non-volatile oil. Pure "S. D. O. Base" cannot be stored practically because it is self-drying even when not exposed to air. However, diluted slightly with high flash naphtha or other suitable solvent it can be kept in full, tight cans indefinitely. It is therefore generally shipped and used with proper predilution by the maker. The solvent evaporates on application, and "S. D. O." turns into a hard, transparent, light amber colored resin coating. "S. D. O." paints are prepared by grinding into "S. D. O." solutions suitable fillers and pigments. Such paint is highly recommended by the maker as a primer for metals because they adhere better than unpigmented solutions, and are also used as priming coats on concrete to prevent excessive penetration.

Among its properties are mentioned extremely high imperviousness to moisture; high corrosion prevention properties; insolubility of the hardened coating in any solvent; imperviousness to acids, alkalies, chlorine, bromine, brine, ammonia, hydrogen sulphide, crude or refined petroleum products. The material is attacked only by certain oxidizing agents, such as concentrated hydrogen peroxide, nitric acid, and hot concentrated sulphuric acid, it is stated. Hydrofluoric acid will penetrate but not destroy the film. It is therefore recommended for protection of wood or concrete floors, industrial tanks, acid vats, etc. It is said to make floors highly wear resistant as well as moisture proof.

The material is applied by brushing or dipping. Spraying is not recommended. Only rigid surfaces not subject to flexing or denting should be covered with it. The surface to be coated should be slightly rough. Successive coats of "S. D. O." paints must be applied before preceding coats are dry.

Besides "S. D. O." oil of several types, the du Pont company offers prepared paints made with "S. D. O.", ready for use. Readers may obtain complete data by addressing the company at Parlin, N. J.





Above—Discus Type Potentiometer Assembled Ready for Use.

At Right—"Standard" Grinders in Plant of Aluminum Industries, Inc., Cincinnati, Ohio.

Direct Reading pH Potentiometers

Hellige, Inc., 179 East 87th Street, New York, announce two new direct reading pH potentiometers, the standard model No. 7000, and the discus model No. 7010.

The company states that while a number of very marked improvements have been made in the standard model, it is in principle not a "trick" machine, but is built on the orthodox plan of Poggendorf. It is said to offer utmost convenience in making pH determinations rapidly. It is equally useful for electrometric titrations, either acid-base or oxidation-reduction. It embodies as an outstanding feature a counting device which permits direct reading of pH values, without calculations or reference to a table after current has been balanced.

The new discus model was designed in response to a demand for a direct reading potentiometer for technical pH measurements and other uses for which maximum accuracy is not necessary. It provides a rapid and practical means of pH determination for the plater, plant chemist, etc. It is also stated to be well adapted to electrometric titrations and lecture demonstrations.

Complete data on these instruments are available from the manufacturer, who has prepared a very comprehensive bulletin, No. 7000, which readers may have for the asking.

Grinders Show Economies

Aluminum Industries, Inc., Cincinnati, Ohio, has replaced several belt driven grinders by high speed individually motor driven units made by The Standard Electrical Tool Company, also of Cincinnati. The speed of the wheels was increased from 6000 SFPM to 9000 SFPM, with a corresponding increase in production of 30 per cent. The old wheels were of aloxite and the new ones of Carborundum Redmanol.

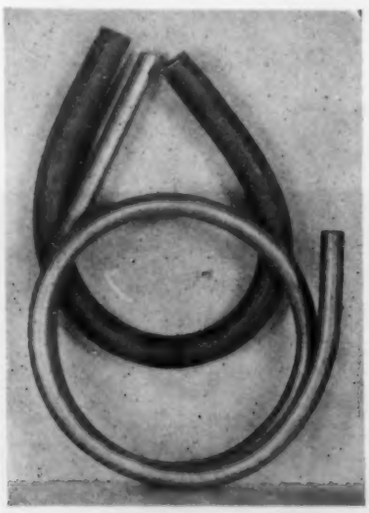
The illustration shows two of the new machines in the foreground. They are 7½ H.P., heavy duty, four-ball-bearing cabinet type. The motor and starting equipment are of General Electric make, and are built in, the motor is mounted on a pedestal, and the control apparatus is in the base, with a push-button station in front of the motor housing as shown in the picture. The speed of the motor is 1750 R.P.M., which, with the 20 in. grinding wheel, gives a peripheral speed of 9000 SFPM. Boiler plate guards are provided which can

be adjusted as the wheels wear, and there is a spark breaker and polished wire glass eye shield.

Immediately behind these two grinders are shown two 5 H.P., heavy duty disc grinders equipped with 18 in. discs and swinging tables, which are also a part of the very moderate equipment of this plant.

New Matrix Alloy—Fusible Metal for Pipe Bending

Cerro de Pasco Copper Corporation, 44 Wall Street, New York City, is a large producer of primary copper and other metals. The company makes a specialty of producing a variety of fusible alloys for various purposes, such as for filling thin-walled tubing prior to bending, for die matrix purposes, for dental laboratory uses, and for children's toy casting sets.



Typical Pipe Bends Made with Cerro de Pasco "Matrix Alloy"

"Matrix Alloy" is a new fusible metal developed by General Electric Company, on which name copyright is pending. It is being marketed by the Cerro de Pasco company, and is intended to provide a superior substitute for the alloys hitherto used for mounting dies and punches. It provides physical properties formerly not available, and is said to obviate such certain difficulties such as drawing of die temper by the temperature required for melting the matrix, shrinkage of the matrix on solidification, softness and peening which allows shifting of die assemblies, and crumbling under heavy service. "Matrix Alloy" is composed of bismuth, tin, lead and antimony. A very fine illustrated booklet has been prepared on it, and is available to readers on application to the company.

Other fusible alloys made by Cerro de Pasco include "Bendalloy," which was developed especially for tube bending use; "Dentalloy," for dental laboratory use; "Safalloy," for use by children, particularly in toy casting sets. The last-named metal melts easily in hot water, turns hard with minimum shrinkage when cooled to room temperature. Literature on all the alloys mentioned is available from the maker.

Casting and Molding Refractory

Quigley Company, Inc., 56 West 45th Street, New York City, has developed a new type of refractory material known as "Cast-Refract." This has great flexibility of application, according to the maker. It can be cast or molded on the job into any desired shape or form, sets rapidly in air, has high structural strength, and can be put under full heat in 24 hours or less. It is especially recommended for special shapes, furnace and oven door linings, and for some intricate refractory construction. It is handled much like a concrete mixture. Shipped dry, it is mixed with water to consistency of stiff mortar for use. The monolithic structures produced from it are said to be air and gas tight, free from shrinkage, highly resistant to spalling, and to have excellent refractory properties up to its temperature limit of 2600° to 2800° F.

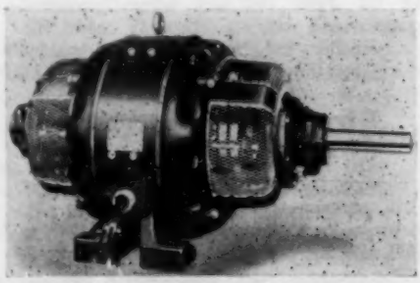
New Die Casting Alloy

Zamak No. 3 is a new alloy for die casting developed by The New Jersey Zinc Company. It is said to be the first of this type to maintain its original physical properties and to be free from dimensional changes during the useful life of a die casting. Tests made in the company's laboratories show that twenty years will bring only slight variations in physical properties. Lower casting temperature is also claimed for the new alloy.

The typical composition of the alloy is: Aluminum, 4.10 per cent; magnesium, 0.04 per cent; the balance Horse Head zinc. Tensile strength runs between 36,600 and 44,000 lbs., with an elongation of from 4 to 6 per cent. Castings with an impact value of from 15 to 20 ft.-lb. are said to have been produced—a very high record.

New Synchronous Motor

Ideal Electric and Manufacturing Company, Mansfield, Ohio, announces a new synchronous motor especially developed for industrial and general applications, known as the "Self-Syn." According to the maker, it is a compact, self-excited, self-



"Self-Syn" Motor

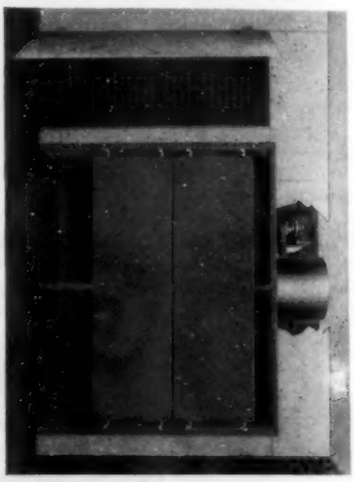
synchronizing, self-contained unit; requires no external excitation, the exciter windings, direct current commutator, etc., being integral with the motor itself; no field switch or complicated synchronizing relay is necessary, as motor is started with a simple hand-operated compensator as ordinary induction motors are started.

"Self-Syn" is said to have, in addition to the advantages of the conventional motor, greater compactness and simpler control equipment; the ability to automatically re-synchronize itself after being pulled out of step by a line voltage dip or a momentary overload, in contrast with syncronous motors which without auxiliary control protection would stall under such conditions. The motors are supplied in all sizes from 5 to 100 H.P., at 900, 1200, and 1800 R.P.M.

The Ideal Electric and Manufacturing Company will supply readers with any additional information desired,

DeVilbiss Exhaust Chamber

The DeVilbiss Company, Toledo, Ohio, manufacturer of spray-painting and finishing equipment, announces a new type of



New DeVilbiss Exhaust Chamber for Spraying

exhaust chamber. This new exhaust chamber is recommended for use where spraying is done in an already fireproof room. It is designed to provide a means of mounting the exhaust fan and to distribute the exhaust properly where a complete spray booth is not required, or where an exhaust fan mounted in the wall or window will not adequately take care of the requirements. In construction, this exhaust chamber is actually the back section of a standard spray booth.

The new DeVilbiss exhaust chamber is placed in the rear of the room and the exhaust pipe is run out through a window or the roof. The space around the chamber may be filled in flush in the front with sheet metal, tile or other noninflammable material, with a door providing access to the exhaust fan. This keeps the fan motor out of the spraying room. The chamber is constructed of 24-gauge sheet steel, reinforced on the edges by a steel frame spot welded. Three widths, 8, 10 and 12 feet, are available. All sizes are 32¼ inches deep and 7 feet high. Exhaust openings are optional in the top, back or side. The unit is easy to assemble and to install. Complete information can be had by readers on application to The DeVilbiss Company, Toledo, Ohio.

Gooseneck Electric Immersion Heater

A new form of electric immersion unit has been developed by the Harold E. Trent Company, 618 North 54th Street, Philadelphia, Pa., which is a modification of their well-known strip heater. The modification consists of an extension of the tubular casing at the terminal end to form a semi-flexible "riser" without any joint in the casing. This riser can be bent over to form a gooseneck, as illustrated, to clear the wall of the bath or container, or it may serve as a support to the unit in the bath.

New Immersion Heater

This immersion unit can be used in tanks or baths made of wood, metal, or refractory material, when it is undesirable to drill holes through the sides.

The casings of these immersion units are made of copper, stainless steel, or other alloys, and lead covered when required on such applications as electroplating tanks.

The lengths of the vertical riser and the heated section, together with the wattage rating, cover a wide range of dimensions. Banks of such immersion units can be used for larger vessels.

Air Weight Controller for Blower Equipment

A new instrument that automatically controls the weight of air delivered to a cupola or blast furnace has been developed by the Foxboro Company, Foxboro, Mass. This air weight controller can be used in conjunction with practically any type of blowing equipment. When used to control the air flow to a cupola, an orifice plate or other primary device is installed directly in the blast pipe. The instrument operates a controlled valve that automatically maintains delivery of the desired weight of air to the cupola.

In controlling the flow to a blast furnace, the orifice plate is located on the suction side of the blower. The control mechanism can be arranged to regulate the speed of the governor controlling the turbine or blowing engine so that the desired quantity of air will be delivered with the least consumption of fuel. An alternative installation is to place the controlled valve in a by-pass line around the blower.

Perhaps the most interesting feature of this controller, says the maker, is the temperature and pressure compensating mechanism which permits the pen to record the weight of air or, if desired, the volume in standard cubic feet. Connecting lines from the primary device in the blast pipe provide a continuous flow of air through the air-tight case thus permitting the compensating mechanism to be under actual line pressure and temperature conditions. The importance of this device will be appreciated when one considers that normal variations in atmospheric temperature and pressure cause the weight of oxygen contained in a cubic foot of air to vary as much as 20 per cent, it is stated.

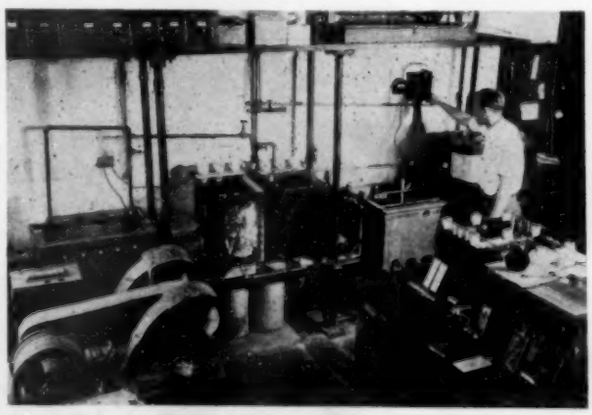
The entire control equipment can be installed in a few hours by an experienced pipe fitter. Readers may have further details by writing to the Foxboro Company.

New Electroplating Laboratory

Zinc, the least expensive of the non-ferrous metals, is easily formed and adapted to most of the usual methods of manufacture. For this reason important study has been made with the object of giving to industry the simplest and most economical methods of plating this metal.

The New Jersey Zinc Company, 160 Front Street, New York, has been actively engaged in electroplating research for several years. The plating solutions and current densities have all been worked out in the experimental laboratory shown in the illustration. Many hundreds of samples have been plated with various types of metal coatings—nickel, nickel-chrome, chromium direct, copper, brass, bronze, cadmium, silver, gold, platinum—to determine the proper plating method and to prepare samples for various aging and service tests.

As the work in co-operation with several industries has expanded, the company has, of course, continually found it necessary to add new equipment. Until the present time this has always been of the laboratory type.



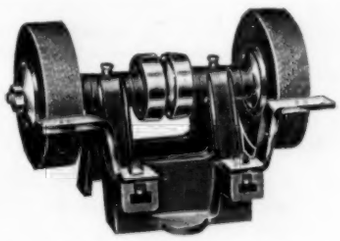
A View of the New Jersey Zinc Company's Facilities for Electroplating Experimentation on a Fully Commercial Scale.

Within the past six months, however, this equipment has been greatly augmented by the addition of tanks and a generator unit of a semi-commercial size. These new laboratories will enable The New Jersey Zinc Company to develop and demonstrate on a practical scale various procedures for electroplating rolled zinc and zinc die castings.

The work which has been done in the original laboratories, together with the information received through co-operative runs in industrial plants, has been thoroughly reported in papers delivered before technical societies and published in industrial journals. A research bulletin "The Plating of Rolled Zinc and Zinc Die Castings," published by The New Jersey Zinc Company to broadcast the result of this work, is considered to be the standard reference work on the subject. It is available to readers on request to the company.

Small Grinders

Modern Grinder Manufacturing Company, 112 South 2nd Street, Milwaukee, Wis., offers a line of small grinding heads for shops, schools and home use. The company states its line includes models for all-around applications in shops, which are inexpensive in first cost as well as in operation. The grinder heads are provided with pulleys for belt operation. A variety of suitable wheels and other accessories are provided.



Light, All-Around Grinder

This company also manufactures a series of electric grinding units which are light and inexpensive. Accessories such as abrasive and buff wheels, brushes, chucks, etc., are available separately or in combination.

Beryllium Chemicals

The Brush Laboratories Company, 3715 Euclid Avenue, Cleveland, Ohio, have developed and are placing on the market a number of beryllium chemicals, some of which are used in the electrochemical lines, both experimentally and commercially.

The line offered includes the following: beryllium sulphate, fluffy beryllium oxide, dense beryllium oxide, sodium beryllium fluoride, beryllium basic acetate, beryllium nitrate, and beryllium chloride.

With regard to electrodeposition, the company states that beryllium cannot be

deposited from aqueous solution. Deposition must be carried out from a fused salt, and sodium-beryllium-fluoride forms a good base. Quite possibly anodes of metallic beryllium could be developed which would prevent the bath from being impoverished. At present, however, graphitic anodes are employed, and the bath is externally heated. The current density can not be too high, or the anode effect is produced.

The bath can be regenerated in various ways, as, for instance, by dissolving and mixing with beryllium sulphate, with reformation of sodium-beryllium-fluoride and sodium sulphate.

It is possible that beryllium chloride could be added continuously to the bath so that it would not become impoverished. While this has not been worked out, some interest may attach itself also to beryllium chloride.

Black Finish for Iron

Waldberg, S. A., 223 Boulevard Pereire, Paris, France, offers a process for finishing iron and steel in black.

The process is stated to consist of a special solution in which iron and steel can be blackened by several minutes' immersion.

Readers interested can obtain complete information by addressing the company.

Rubber Paints

A new line of rubber paints, developed very recently and marketed in a quiet way, is thoroughly discussed in a recent bulletin of The B. F. Goodrich Rubber Company, Akron, Ohio. Titled "Acidseal Paints," the bulletin is a manual of recommendations for paint problems, and tells about rubber derivatives that minimize the corrosive action of acids and alkalies on materials.

These paints have as a base a commercial form of rubber isomer, developed by the Goodrich laboratories, which imparts valuable properties not found in ordinary paint films and characterized as follows:

(1) Exceptional properties of adhesion when applied to a properly prepared surface.

(2) Dry in one hour to a hard firm film but retain to a remarkable degree the elastic properties of rubber and consequently conform to the expansion and contraction of the support.

(3) Retaining the well known chemically resistant properties of rubber, they provide a protective coating that minimizes the corrosive action of acids, alkalies and chemical fumes. Film is not water absorbent.

The bulletin discusses selection of proper paint and primer for various purposes, methods of application, ingredients, describes finished results, spreads per gallon and operations in which different types have been used successfully. It also says that the Goodrich research division is ready to work on any paint problems for special purposes.

Copies of the bulletin may be had by readers on request to the manufacturer.

Steckel Cold Rolling Mill

The Cold Metal Process Company, Youngstown, Ohio, offers the Steckel cold rolling mill for production of strip and sheet metal. The company states that the mill, developed by A. P. Steckel, together with the accessory equipment for operating the Steckel process of rolling, provides the following major advantages: elimination of intermediate annealing in process; operation at 5 to 6 times the speed of other mills; maintenance of accuracy to gauge within one-third the limits maintained by other mills.

For the nonferrous industry the mill is recommended by the company for rolling of nickel, monel metal, aluminum, copper, brass and other metals. An installation at the plant of the International Nickel Company, at Huntington, W. Va., is reported to be highly successful in rolling pure nickel.

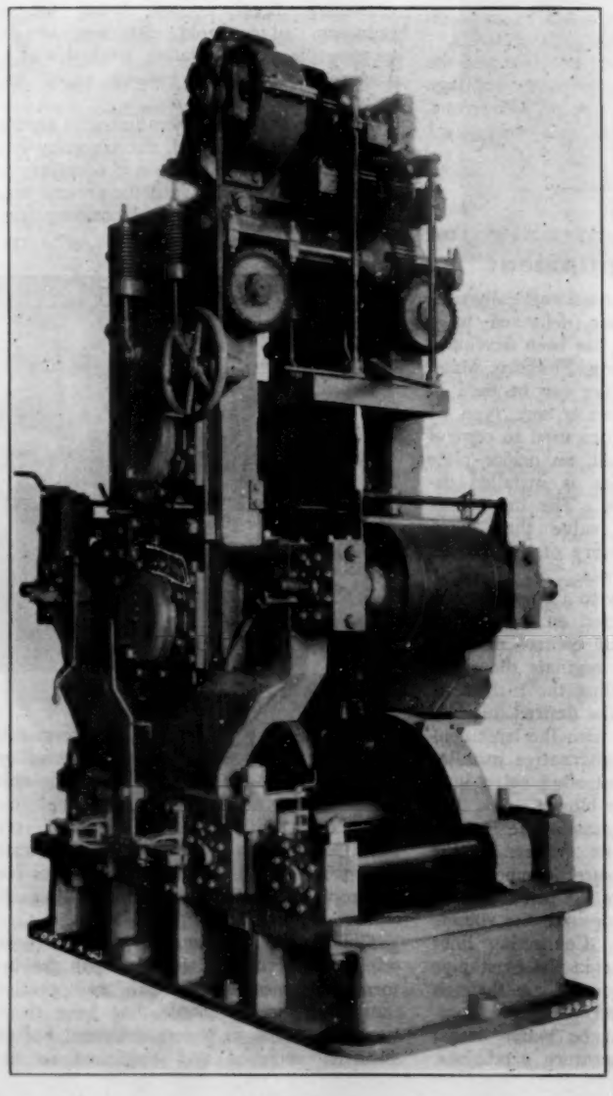
It is stated that the Steckel process provides a means of reducing costs substantially, and also of producing wide sizes and light gauges of material not possible by any other method.

An interesting illustrated folder describing the operation of the Steckel process is available to readers on application to the company.

Acid-Handling Equipment

A new type of lead-coated steel drum of 10 gallons capacity, suitable for handling, shipping and storing acids, has been designed by the Gross Engineering Corporation, 3955 West 25th Street, Cleveland, Ohio. Larger sizes can also be supplied. The new drum conforms to the 5-A specifications of the Interstate Commerce Commission Bureau of Explosives for use with sulphuric acid of all strengths, battery acid, electrolyte acids and hydrofluoric acid, as well as for phosphorus liquid compounds, bromine and other liquids which do not attack lead.

The outer shell is made of heavy sheet steel, welded at all seams. The interior is entirely covered by a protecting coating of lead by means of the Gross "Leadhesion" process. An interesting feature is the renewable outlet or outlets from which the acid is poured. Outlets are made in two parts, united by a threaded joint, a thick coating of lead being put on the inner sides normally exposed to acid. The strength



One Type of Stekel Mill for Cold Rolling Metals.

of this type of construction may be judged by the tests required by the I. C. C. 5-A test already referred to—part of which test consists of an 80 pound per square inch hydrostatic pressure test, and of dropping a 98 per cent acid-filled drum six feet on to a concrete floor. The drum may therefore be easily and safely handled by rolling, slinging, skids, or any other of the usual methods adopted for ordinary materials. Besides being practically unbreakable the drum is easily kept in good condition through the renewable outlet feature, and because there is no wood container to be constantly renewed. Safety is assured because the threaded cap cannot work loose, and the shape of the drum makes it difficult to upset. These features earn lower freight rates, as well as economizing storage space, it is stated by the maker.

Atomizing Nozzle

A new type of atomizing nozzle for spraying operations is offered by Spraco, Inc., 114 Central Street, Somerville, Mass. The company makes the products formerly produced by Spray Engineering Company and Spraco Painting Equipment Company.

The new product, the Type HF nozzle, operates in a fixed position to apply coatings on metals passing on a conveyor, or

New Spraco Nozzle

lubricants on metal sheets being fed through a blanking or drawing press. The maker's description states that the nozzle consists essentially of a bronze body with inlet connections for air and fluid on opposite sides. Air orifice is a narrow milled slot, with needle valve volume control and locknut setting. Fluid orifices are on both sides of the air orifice. The nozzle cap has slotted orifice which delivers a wide angle, fan-shaped spray. Nozzles are easily arranged in batteries to cover very wide surfaces, and union joint connections make it easy to remove any nozzle without disturbing the others. Volume of spray is regulated by varying relative air pressure and fluid supply.

The nozzles operate on suction, and at 30 lbs. air pressure the nozzle has a suction lift of approximately 5 ft., the maker states.

Bulletin on Cold Mills

United Engineering and Foundry Company, Pittsburgh, Pa., has just issued a bulletin on precision mills for cold rolling sheets and strips in all commercial metals; for work ranging from laboratory operations on tungsten and rare elements up to high-tonnage plants; from heavy gauges down to thinnest foils and flat wires.

Equipment and Supply Catalogs

Scales. The Kron Company, Bridgeport, Conn. Bulletin on completely redesigned line of automatic industrial scales. Fully illustrated.

Industrial Lighting Equipment. Westinghouse Electric and Manufacturing Company, Cleveland, Ohio. Catalog 219-A; 64 pages; fully illustrated.

Rolling Grilles and Gates. Cornell Iron Works, Inc., 3610 13th Street, Long Island City, N. Y. Illustrated leaflet on a new and interesting product.

Foremen's Safety Conferences. Metropolitan Life Insurance Company, New York. Programs for a series of seven foremen's conferences on safety.

Stokers. Combustion Engineering Corporation, 200 Madison Avenue, New York. Bulletin on Type E stoker unit for medium sized heating and small industrial boilers.

pH Potentiometers. Hellige, Inc., 179 East 87th Street, New York. Bulletin 7000; two new direct-reading instruments for scientific and technical use in pH determination. Illustrated.

Refractory. Quigley Company, Inc., 56 West 45th Street, New York. Bulletin on Cast-Refract, a new type of castable refractory for forming special shapes, making linings, and other furnace room uses.

Personals

George Birkenstein

The National Association of Waste Material Dealers is an organization composed of all branches of the scrap, waste and secondary products business. This includes the metals, and recently the association elected a metal man president. George Birkenstein, the man thus honored, comes of a family of metal men. His grandfather founded the firm of S. Birkenstein and Sons, Chicago. His father was one of "sons." Today, George Birkenstein heads the company's metal division, known as the Globe Metal Company, refiners of scrap and secondary metals and producers of a variety of white metal and other ingot. He is a director of the parent concern, which is one of the largest of its kind in the country. Besides this, he is vice-president of the Clay Reduction Company, Chicago. Other activities of Mr. Birkenstein include his directorship in the Chicago Association of Purchasing Agents; participation in the affairs of the Chicago Branch of the American Institute of Mining and Metallurgical Engineers; a continuous interest in research in nonferrous metals. Besides this he is a member of several clubs and interested in civic affairs considerably.

George Birkenstein was born thirty-three years ago. He is married and has two children. He attended college at the University of Michigan, was in the army during the war. In 1920 he went into the family business, learned it from the bottom up. He has progressed rapidly, and his eminence in the secondary metals refining industry at such an early age makes it logical to suppose that his stature as a metal man will continue to grow.

George Birkenstein

W. H. Scott has been appointed general sales manager of The Duriron Company, Inc., Dayton, Ohio, succeeding **T. D. Slingman, Jr.,** resigned. Mr. Scott has been with The Duriron Company for thirteen years, having had charge of the Atlanta Division and later the Philadelphia territory. In 1929 he became sales manager of the industrial department, and head of the technical department. He is chairman of a sub-committee of the American Society for Testing Materials on Sulphuric Acid Submerged Corrosion, and is a competent chemical engineer.

Obituaries

Stewart Hill Jones

Stewart H. Jones, founder of the Canadian Bronze Company, Ltd., Montreal, Canada, died of heart disease September 5, 1932, at his summer home at Sharon, Conn. He was sixty-seven years old, and had been ill for some time.

Mr. Jones is credited wtih having revolutionized the bronze industry. When he opened his first plant, the St. Thomas Brass Company, in St. Thomas, Ont., in 1900, the Canadian railroads were manufacturing their own brass equipment. Mr. Jones prevailed upon rail executives that it would be more economical for the railroads to abandon their brass plants and purchase their brass castings and journal bearings from outside manufacturers. The plant received its first order from the Michigan Central and later supplied the Canadian National and the Canadian Pacific.

With the expansion of the industry, Mr. Jones founded the Northwestern Brass Company, Ltd., with plants at Winnipeg and Calgary, and the Canadian Bronze Company, Ltd., with factories at Montreal. When his health failed in 1927, Mr. Jones sold his companies to a Canadian syndicate. Until his retirement he maintained offices at 2 Rector Street, New York.

Mr. Jones was born in Detroit, June 15, 1865, the son of the late George Clinton Jones and Elizabeth Hill Jones. He was educated in Detroit and then entered the Magnus Company's plant in Buffalo, where he soon was appointed general manager.

Thomas F. McDonald

Thomas F. McDonald, who founded the Dayton Brass Castings Company, Dayton, Ohio, died September 7, 1932, at the age of 73. He retired from active management of the brass foundry concern several years ago. He was born in Ireland, and came to this country at the age of five. He went to Dayton in 1905 and entered the employ of the Platt Iron Works, where he remained until he organized his own firm. He is survived by his widow, several children and grandchildren, and a brother.

T. F. Jennings

T. F. Jennings, for twenty years foundry superintendent for the Utah Copper Company, Garfield, Utah, died recently at Salt Lake City after a brief illness. He was seventy-four.

Mr. Jennings was widely known in the foundry industry. Before his connection with the Utah company he had traveled for a time as a field representative of the National Founders' Association. Before that he was a molder, and traveled considerably in that capacity. Born in Massachusetts, he entered the foundry industry in the east. He was interested in advancing the technique of the industry, and in recent years he carried on extensive experiments in production of cast iron grinding balls used in copper ore reduction. He presented papers on the subject at foundrymen's meetings, and also published some of them in journals devoted to iron foundry work.

Otto Donatz

Otto Donatz, well known Trenton, N. J., manufacturer, died recently at a Trenton Hospital, following a three weeks' illness. Mr. Donatz was 67 years old, and was a manufacturer of mechanical flue cleaners and power plant equipment. He is survived by his widow.—C. A. L.

Frank J. Gorse

Frank J. Gorse, assistant treasurer of the Scovill Manufacturing Company, Waterbury, Conn., died suddenly at his home there on October 1, 1932. He was born in New York seventy years ago, son of Mr. and Mrs. Calder Gorse. His father was for many years prominently identified with the New York firm of H. B. Claflin.

News of Associations and Societies

American Electroplaters' Society

Annual Convention, 1933, at Chicago

The Chicago Branch extended an invitation to the Society to hold the annual meeting of 1933 in Chicago. This was accepted, and Chicago will be the 1933 Convention City.

The Chicago Branch immediately started to work, and it is going to be a great pleasure for the boys of the Chicago Branch to serve the officers, delegates, members and visitors who attend.

Besides the many advantages which Chicago offers as a great convention city, we are most fortunate in having as an added attraction the Century of Progress Exposition, to be held in observance of the Centennial of Chicago, and to open June 1, 1933. This exposition will tell by easy stages and in simple form the story of scientific discoveries and inventions, their application to industry, and the resultant transformation that has made the world of today so different from the world of a century ago.

This Century of Progress applies directly to all those who are today engaged in the art of electrodeposition of metals, due to the fact that in 1833 a great scientist made a discovery in his basement laboratory in England which is the foundation that made possible the production and control in the plating industry today. Therefore the year 1933 is the One Hundredth Anniversary of the discovery by Faraday, known as "Faraday's Law." This discovery that the amount of disassociation of any given metal is in direct proportion to the amount of current passing through the electrolyte, was the beginning of what is today the plating industry.

Platers, and all those associated directly or indirectly with the industry, owe very much to the genius of Dr. Michael Faraday, and to show this appreciation in a small way the Chicago Branch has arranged with Dr. I. E. Muskat of the Basic Science Division, Century of Progress Exposition, to declare and dedicate Wednesday, June 28, 1933, as "Faraday Day." Arrangements are being made to hold suitable exercises in the Science Building. An eminent scientist from England will deliver the principal address to the visitors at the convention, and will tell us of Faraday and his accomplishments. The Chicago Branch is really happy to honor one who is responsible for our means of livelihood today.

The Convention Headquarters will be located in the Congress Hotel, one of the best in Chicago. It is on beautiful Michigan Avenue, overlooking Grant Park, and in the near distance grand old Lake Michigan is ideal. A short walk takes one to the Main Entrance of the Century of Progress Exposition. Directly across from the hotel is a beautiful esplanade, with walks leading to the world famous Buckingham Fountain, all of which is visible from the hotel rooms. This fountain shooting hundreds of streams of water, some as high as 150 feet in the air, with a constantly changing colored light effect, is a gorgeous sight. The Congress Hotel is in appointments second to none, and its management is noted for courteous treatment and cheerful service. Its cuisine is famous the world over.

To better acquaint you with the character of Chicago and its advantages as a Convention City, the Committee has arranged

a series of eight articles with illustrations which will be published in these columns monthly. All interested should read these articles carefully in order to enjoy the visit to Chicago next summer to the fullest extent.

The dates selected for the 1933 Convention are June 27 to 30, 1933. That will be Tuesday, Wednesday, Thursday, Friday. These dates were selected so that delegates, members and visitors will have ample time after the close of business on Saturday, June 24, to reach Chicago by Tuesday, June 27, either by train, auto or boat; and after the close of the convention it will allow Saturday, Sunday, and Monday to visit the Exposition, and reach home in time for business July 5.

Owing to the large number of visitors expected in Chicago, and the numerous conventions to be held during the time selected, the Committee wishes to urge all members, delegates and visitors to make the Congress Hotel their home as well as their headquarters while in Chicago. This will keep us all together and help the Committee to serve all with a maximum of efficiency and mutual pleasure.

One fact the committee wishes to indelibly impress upon the mind of each member of the American Electroplaters' Society is: You Cannot Afford to Miss this Convention. Start your Convention Savings Fund right now, and be prepared to take advantage of Chicago's hospitality with its unsurpassed features for your education and entertainment.

C. S. TOMPKINS, General Chairman.

American Welding Society

The twelfth fall meeting of the American Welding Society was held October 3-7, 1932, at Buffalo, N. Y. The meeting was well attended. The various sessions brought out numerous technical and scientific papers on welding subjects. Included was a session devoted to nonferrous welding, when the following papers were presented: Welding of Duralumin, by a representative of Union Carbide and Carbon Research Laboratories; Welding High Nickel Alloys, by J. G. Shoener and F. G. Flocke, International Nickel Company; Lead "Burning" or Welding, by R. L. Ziegfeld, Lead Industries Association.

Headquarters of the American Welding Society: 29 West 39th Street, New York.

Industrial and Financial News

Federal Specifications on Aluminum Products

Federal Specifications Board, Washington, D. C., has issued sheets on proposed Federal specifications on aluminum bars, rods, shapes and wire; garden and water hose couplings; and on aluminum alloy (aluminum-manganese) bars, rods, shapes and wire (second reading of latter). These are planned to cover purchases by various government departments and establishments. Interested manufacturers and others can obtain copies from the Board, and comments are invited up to ten weeks after September 14, 1932.

Russia Buys Aluminum

A large tonnage of aluminum transmission wire was recently ordered from the Aluminum Company of Canada, Ltd., by the Soviet government, according to press reports. Value of the business was placed at close to $500,000. Payment will be made partly in Russian oil, it was said.

Brass Ingot Statistics

Non-Ferrous Ingot Metal Institute, Chicago, Ill., reports average prices per pound received by its membership on commercial grades of six principal mixtures of ingot brass during the twenty-eight day period ending September 9, as follows, with which we supply comparative prices reported for the period ending August 12:

	Month Ending Sept. 9	Month Ending Aug. 12
Commercial 80-10-10 (1% Impurities)	6.835c	6.686c
Commercial 78%	5.066c	5.002c
Commercial 81%	5.290c	5.250c
Commercial 83%	5.579c	5.745c
Commercial 85-5-5-5	5.883c	5.763c
Commercial No. 1 yellow	4.402c	4.276c

The combined deliveries of brass and bronze ingots and billets by the members of the Institute for the month of August, 1932, amounted to 1,758 tons.

On September 1 unfilled orders for brass and bronze ingots and billets on the books of the members amounted to 18,790 net tons.

Abrasives Simplification

The Division of Simplified Practice, Department of Commerce, Washington, D. C., announces that the required degree of acceptance has been accorded the current revision of the simplified practice recommendation R89-32 covering coated abrasive products, and it is to become effective on October 1, 1932. The original draft of this recommendation was formulated and developed by industry in 1928. The present changes were proposed by a representative standing committee of the industry for the purpose of bringing the recommendation into accord with current demand.

Data on Solders and Soldering

The United States Bureau of Standards, Washington, D. C., has prepared an eight-page circular on Solders and Soldering. Three classes of solders are described—soft solders, hard solders, and aluminum solders, the composition and properties of each of which are presented in detail. Methods of application and suitable fluxes are thoroughly discussed. A short bibliography is also included. Copies of the circular may be had on request to the bureau.

Bottlers' Exposition

Makers of various metal products used in the carbonated beverage bottling business will be well represented at the International Beverage Exposition, to be held November 14 to 18, 1932, at Cleveland, Ohio, in connection with the annual convention of the American Bottlers of Carbonated Beverages.

International Silver On Heavier Schedule as Business Picks Up

Press reports at the end of September stated that plants of the International Silver Company, Meriden, and Derby, Conn., are preparing to operate full time, 50 to 55 hours weekly, due to a special rush order and also because of a pick-up in its regular business. At Derby, it was stated, the force was doubled and a night shift added. Quoting Charles H. Smith, manager, the report said the company is optimistic on conditions. K. G. Merrill, eastern division manager, was quoted as follows:

"We have experienced an increased demand for all of our nationally advertised branded lines of silverware, and I feel that the increase is of more than a seasonal character, although this is the season when we normally get larger orders, due to stocking up for the Christmas trade.

"I can't help but feel that trade conditions are better. Silverware is classed as a luxury, with the result that it usually is one of the first lines to feel a depression and one of the last to experience a revival. Actually, however, it is a necessity which the public ultimately feels it must have. The public has been using cheap substitutes during the depression, but now is beginning to demand a better grade of goods. Dealers feel this increasing call for better merchandise and are stocking up. They had permitted their inventories to run low.

"I predict a genuine buyers' rush for goods later on based on expectations that prices will be higher and a desire to replenish supplies before the expected advance takes place."

Corporation Reports

TORRINGTON COMPANY, Connecticut: reports for fiscal year ended June 30, 1932, net profit of $1,650,152, against $1,740,343 for preceding year.

Riehle and Torrington in Manufacturing Agreement

Riehle Brothers Testing Machine Company, Philadelphia, Pa., and Torrington Manufacturing Company, Torrington, Conn., have entered into an agreement whereby Torrington will make the Riehle line of machines and instruments. Riehle will retain its corporate identity, continue to conduct its engineering and sales. The arrangement provides superior machine building facilities for the Riehle line, it is stated. The Riehle company has been in business since 1825, specializing in physical testing equipment. Torrington, organized in 1885, manufactures special machinery, largely for strip, sheet, rod, wire and cable mills, and press and screw machine products.

Incorporations

Standard Metals Company, 1554 Franklin Street, Detroit, Mich.; scrap metals; 1,000 shares no par stock.

Maas Metal Products Corporation, 1480 Merchandise Mart, Chicago, Ill.; stainless brass, bronze and steel products, cast, hot rolled, bar stock, sheet, etc., copper alloys; by James H. Hicks and associates.

Benjamin Stewart and Sons, Inc., Mt. Carmel, Conn.; nonferrous jobbing foundry, casting aluminum, brass, bronze, etc.; by Benjamin Stewart and associates. Mr. Stewart formerly was manager of Bridgeport Deoxidized Bronze Company, Bridgeport, Conn., and is widely known in the foundry business.

Meco, Inc., 3879 North Richards Street, Milwaukee, Wis.; by five former members of engineering staff of A. O. Smith Corporation, Milwaukee; to manufacture general line of metal specialties and provide mechanical engineering service. W. E. Richter, president; John Dilot, vice-president; G. E. White, secretary; R. A. Lee, treasurer, and W. Hartje, factory manager.

McConnell Bronze Casting Company, 32nd and Smallman Streets, Pittsburgh, Pa., is a new corporation under the active management of **E. E. McConnell,** who has had many years of experience in this line. It is now in operation, producing bronze and aluminum castings of all sizes and for all purposes.

News From Metal Industry Correspondents

New England States

Waterbury, Connecticut

OCTOBER 1, 1932.

Waterbury Clock Company has been under a receivership during the past month on a petition of the majority stockholders. However, refinancing plans have now been accepted which are expected to result in lifting the receivership. Receivership was asked because of shortage of cash to meet payrolls and bank loans and pay for raw materials, and virtual impossibility of making new loans. There were plenty of orders on hand and these have been increasing. Prior to the receivership, virtually the entire working staff was laid off for two weeks.

When the receivership was ordered, **Landdon H. Roper,** president, and **L. Allen Osborne, Jr.,** were appointed receivers for the company and its subsidiaries, the **Ingersoll-Waterbury Company** and the **Brach Time Company.** It was felt that under receivership it would be possible to make a loan so that business could be continued. A loan of $200,000 was authorized but not exercised as the new financing plan was adopted. Application for receivership was made by the holders of 21,626 of the company's 40,000 shares of stock, plaintiffs and their holdings being: **Irving H. Chase,** 6,476 shares; **Frederick S. Chase,** 2,150 shares; **Mary White,** 2,000 shares; **Arthur R. Kimball,** 2,000 shares; **Lucy Dye,** 3,000 shares; **Helen Chase,** 2,000 shares; and **Elsie Chase,** 2,000 shares. While the receivership was on, nearly 1,400 of the former employes were hired back.

Then **James R. Sheldon,** son-in-law of **Irving H. Chase,** chairman of the board and former president and treasurer, offered his re-financing plan as follows: That $500,000 of 6 per cent preferred stock be issued which he would purchase, this stock to carry sole voting power until retired, and no dividends to be paid on common until the preferred is retired; that it carry a conversion privilege into common, share for share; that the bank loans be reduced 20 per cent annually, and more rapidly if possible; that the receivership be lifted and the preferred take entire control; that the present authorized capital of $4,000,000, consisting of 40,000 shares of common at $100 par be reduced to $1,000,000 by making the par value $25; that the present directors resign in favor of a new board to be elected by the preferred stockholders.

A stockholders' committee consisting of **John H. Goss, Bennett Bronson** and **Walter Holmes** was appointed to consider the offer. At a court hearing on the continuance of the receivership, the receivers indicated some opposition to the plan. Mr. Osborne said those making the offer believed in a decided change in policies, while the receivers favor a gradual expansion as there are substantial orders to make the plan work. There are more unfilled orders on hand now than for many months, among them one for 325,000 watches from **Sears, Roebuck and Company,** and a large order for electric clocks from the **Kresge Company.**

It was brought out that the company owed the Chase National Bank of New York, $100,000; the New Haven National Bank, $100,000; the Waterbury National Bank, Colonial Trust Company and Citizens and Manufacturers National Bank $50,000 each; $49,577 for merchandise, and $44,572 on open accounts.

The stockholders' committee did not favor some of the points in the re-financing proposition and at its request, Mr. Sheldon made some modifications which were adopted by the majority of the stockholders. The chief modifications in the original plan are: the issue of $1,000,000 preferred stock instead of $500,000, and all common stockholders to be allowed to subscribe on a pro-rata basis, Mr. Sheldon to buy $500,000 as originally proposed; dropping of the proposed conversion privilege; and that the common stock be restored to voting power when dividends have been paid on the preferred for three successive years.

At the next court hearing on the receivership it was stated that the receivership will be lifted as soon as the details of this plan are worked out, which will be within a few days. One result of the receivership was a 10 per cent cut in pay for all employed. However, the number of employees has now been increased to 1,800, and is expected to be 2,200 within a month.

Chase Companies, Inc., reports an increase in the number of orders received during the month of August. Rodney **Chase,** secretary of the company, said the increase may be caused by the rise in the price of copper and the corresponding rise in the price of brass, or it may indicate a genuine upward swing of business as a whole.

American Brass Company made two ¼c. per lb. increases in copper and brass products during the past month. **President John A. Coe** says this does not necessarily indicate a pickup in business, being due solely to increased price of copper. However, with the tendency of the trade to buy on a rising market, it is reasonable to expect increased prices to be followed by increased orders. These two are the first increases in the price of brass in nearly a year, he said.

Two employees of the local branch of the **International Silver Company** were arrested by plant watchmen while carrying out silverware valued at $50. The company has been missing silverware for several months, and the total amount lost has been considerable.—W. R. B.

Connecticut Notes

OCTOBER 1, 1932.

HARTFORD—The **Underwood Elliott Fisher Company** will transfer manufacture of Underwood portable typewriters from Bridgeport to this city. This will mean an increase of 20 per cent in the number of local employees, and all Underwood typewriters will then be made at the local plant. Some of the Bridgeport employees will be brought here.

Colt's Patent Fire Arms Company paid its regular quarterly 25c. dividend September 30.

BRISTOL—Walter E. Spicer, 61, assistant treasurer of the **Sessions Foundry Company,** died September 1, following an operation. He entered the company's employ as a stenographer 34 years ago. He leaves his wife and two children, Walter E. Spicer, Jr., and Mrs. George Graham.

The **Sessions** foundry has been closed for nearly a month for lack of orders. Most of the year it has operated only one or two days a week, with a small number of employees. For many years it did a large business and had nearly 500 employees.

E. Ingraham Company has increased its working force to 1,400, which is only 200 less than in boom times. Practically all departments are on a full time basis. There have been no cuts in the daily wage scale, but there have been revisions downward in the piece-work rates. The company paid the annual bonus to all employees last April. It is now specializing in wrist watches and makes over 2,000 daily.

MERIDEN—Reports from the **International Silver Company** show a firmer tendency in August, in advance of the seasonal increase, which usually does not start until September, and grows until nearly Christmas. Although silver has risen about three cents a pound, there is no expectation of increased prices of silverware. The company declared a $1 dividend on preferred, payable October 1.

Aeolian Company has closed its plant at Garwood, N. J., and is concentrating production at its plant at East Rochester, N. Y. The local plant is making shipments to that plant and to the plant at Dorchester, Mass.

Charles Parker Company of this city and **Artistic Bronze Company** of Bridgeport will be merged under the name of the former, and the business is expected to be moved to this city. The local concern will broaden its production of hardware specialties by this acquisition. **William Wright,** president of Artistic, becomes vice-president and a director of the local concern, and will be in charge of the New York office. The Bridgeport plant now employs about 75 hands; it used to employ several hundred.

NEW BRITAIN—North and Judd Manufacturing Company, after payment of dividends amounting to $150,000 and charging off $98,746 for depreciation, showed a decrease of $142,571 in surplus, according to its June 30th report, the present surplus being $500,542. Working capital shows net quick assets of $1,132,709, equivalent to $11.33 a share, whereas the stock is being offered at $10. This disregards the company's plant and equipment, patents and investments in other securities. A year ago the quick assets were equivalent to $13.56 a share. Current liabilities have declined from $133,869 a year ago to $15,931.

Landers, Frary and Clark reports an improvement in business during the past two months, and is re-engaging many former employees.

WINSTED — William L. Gilbert Clock Company salesmen have just completed their first visit to the trade this year and report increased business and much improvement in sentiment. Orders anticipating holiday demands have been large. The plant is now operating full time as a result of business developed through new designs brought out.

Leisure Moment Puzzle Company has begun operations with 30 factory employees and two salesmen on the road. The employees are working in two shifts of eight hours each.

Irving Trust Company of New York has been appointed trustee for the federal receiver of the **Polymet Manufacturing Company,** and it is expected the contemplated sale of the local plant will be postponed until a later date. It is reported that offers have been made for the plant.

TORRINGTON — Local manufacturers have formed an agreement for better distribution of employment by operating their plants 40 instead of 55 hours weekly. **Torrington Company, Fitzgerald Manufacturing Company, Hotchkiss Brothers Company** and **Union Hardware Company** are participating in it. One department of the Torrington Company has been working overtime recently on a special electrical appliance.

BRIDGEPORT — American Chain Company has developed a new machine and chemical process for cutting the hardest materials, including glass, tile, porcelain and mineral stone. **Walter B. Lashar,** president, has just returned from a trip to Europe where demonstrations were held. Production of the machinery will be started at the local plant at once. The company's branch at Birmingham, Eng., is operating at capacity, and has orders requiring continuous operations for at least a year.

THOMASTON—Seth Thomas Clock Company, which has been practically closed for the past two months, has started up with a much larger working force and longer working hours. Several large orders have been received for advertising clocks of a novelty nature, including one from one of the country's largest manufacturers of a bottled drink. The face of the clock is so constructed that the bottle tips and fills a glass as the hands rotate. Another type is being produced for an automobile tire manufacturer. The plant was practically shut down until the surplus stock could be disposed of, and this has now been effected. Plans are being drawn for the construction of a new wing to the main plant but **Vice-President Mason Adams** said construction will not start until next year because of low finances.

NORWALK—It is reported that **Lockwood Manufacturing Company,** manufacturer of hardware, may move to Fitchburg, Mass., where it has a branch plant.

MIDDLETOWN — Suit has been brought by **T. Macdonough Russell** and **Daniel R. Weedon,** receivers for **Russell Manufacturing Company,** to recover damages of $550,000 from a subsidiary of the company, Russell Manufacturing Company Sales Division, Inc., for goods sold by the parent concern. This suit is part of the business involved in winding up the receivership.

DANIELSON—E. H. Jacobs Manufacturing Company has acquired **General Supply Company.** The concerns manufacture competing lines of mill supplies. **Luther Pilling** will continue in charge of production at General, and will assist in an advisory capacity in the Jacobs company.—W. R. B.

Providence, Rhode Island

OCTOBER 1, 1932.

In the list of individuals, firms and corporations that are taxed in the city of Providence on a valuation of $50,000 or over, under this year's assessment just certified by the Board of Tax Assessors to the City Treasurer for collection are more than a score of concerns identified with the metal trades, as follows, with the amount of their assessment: **Allen & Reed Inc.,** $223,960; **American Brass Co.,** $50,000; **American Emery Wheel Works,** $408,640; **American Screw Co.,** $2,461,120; **H. J. Astle & Co. Inc.,** $51,500; **American Standard Watch Case Co.,** $55,000; **B. A. Ballou & Co. Inc.,** $125,300; **George F. Berkander,** $371,560; **Brown & Sharpe Manufacturing Co.,** $8,042,880; **S. B. Champlin Co.,** $296,300; **Clark & Coombs Co.,** $62,000; **W. H. Coe Manufacturing Co.,** $105,600; **Cook, Dunbar, Smith Co.,** $110,680; **Cohn & Rosenberger, Inc., of R. I.,** $319,100; **E. M. Dart Manufacturing Co.,** $279,360; **James C. Doran & Sons,** $301,000; **Theodore W. Foster & Bro. Co.,** $202,460; **Fray Jewelry Co.,** $95,600; **General Chain Co.,** $107,200; **Gorham Manufacturing Co.,** $1,687,420; **The Hadley Co., Inc.,** $145,480; **Imperial Armour Rex Co.,** $84,900; **Improved Seamless Wire Co.,** $118,280; **Irons & Russell Co.,** $276,680; **Mason Manufacturing Co.,** $67,540; **New England Butt Co.,** $262,240; **Nicholson File Co.,** $1,741,300; **Ostby & Barton Co.,** $602,140; **Phillips Lead & Supply Co.,** $131,080; **Screw Machine Products Corp.,** $60,000; **Henry D. Sharpe,** $987,080; **J. T. Slocom Co.,** $160,540; **Speidel Corp.,** $60,000; **Louis Stern Co.,** $76,980; **Archibald Silverman** *et ux,* $242,400; **Uncas Manufacturing Co.,** $101,000; **Vennerbeck & Clase Co.,** $60,000; **Waite, Thresher Co.,** $223,380; **D. M. Watkins Co.,** $214,980; **Williams & Anderson Co.,** $139,860. The total assessed valuation of these forty taxpayers is $21,312,420.

Charles A. Mealy, formerly for a number of years with **The Hadley Com-**

pany, Inc., has been elected president and treasurer of the **Reliance Manufacturing Company**, 144 Pine Street. The latter concern was formerly owned by **David A. Hart** and **Dexter E. Partelow**, who have sold their interests and retired from the business.

The Metal Findings Manufacturers' Association resumed its regular monthly luncheon meetings on Wednesday, Sept. 7, at Narragansett Hotel, with **President Ralph Gregory**, presiding. Routine business was transacted, followed by a discussion of business conditions, prospects, and credits.

Farr & Read Co., Inc., has been incorporated to deal in machinery, authorized capital, 1,000 shares common, no par. The incorporators are: **John M. Farr**, 76 Lenox Avenue; **Harry B. Read** and **William J. Burns.**

To provide work for some of its employes who otherwise might have been idle during the depression, **The Gorham Manufacturing Company** undertook numerous small jobs of repair and improvement in and about its plant at Elmwood. One of these was to install a heating system under the sidewalks leading to the main entrance so that the walks may be kept clear of ice and snow during the winter.

Frederick C. Martin, for the past ten years associated with the **Rhode Island Welding Company**, has opened the **State Welding Company**, 421 Harris Avenue, specializing in all kinds of welding for factories, mills, garages and construction work. W. H. M.

Western Massachusetts

October 1, 1932.

While the upturn among the 26 metal working firms in Western Massachusetts has not been as great as press reports indicate it has been in other sections of the country, the increase in business is far more than seasonal, and manufacturers feel that the present recovery is indication of a permanent trend for the better which will be even more manifest in the spring.

Business at the **United American Bosch Company** is picking up decidedly, and whereas the officials are not prepared to be exceedingly optimistic, they do, however, feel that in view of their recent orders business is indeed on the upturn.

Orders at the **Indian Motor Cycle Company** recently have been better, and company authorities are hopeful that the upward trend in their business will be continued.

Business at the **Westfield Manufacturing Company**, now in receivership, is in a rather indefinite condition, while affairs at the **Central Specialties Company** in Westfield are better than they have been since early in the spring. Their business in itself seems in a measure to indicate that many of the firms in this vicinity are preparing to increase output.

The machine tool industry in this district is slightly improved. At the **Bausch** company orders have increased considerably recently, and the same is true at the **Van Norman Company**, according to officials at both plants. Orders from the automotive industry have been the main cause of the improvement.

Business at the **Westinghouse** plants in East Springfield and Chicopee Falls is decidedly on the upturn, and plant officials are inclined to the belief that there will be no letdown for some time. G. B. Y.

Middle Atlantic States

Central New York

October 1, 1932.

There are some signs of pickup in the Central New York area, but nothing that manufacturers are going into any cheering session over.

American Emblem Company, New Hartford, is now at work on an order for 500,000 key tags for the Texas Oil Company. "Things appear to be somewhat better," an executive of that company said.

An addition to the **Horrocks-Ibbotson Company**, Utica, is under construction. Additional floor space is needed because the company has added 300 items to its line of fishing tackle.

Remington-Rand plants will not combine at this time, and the proposed merger has been postponed indefinitely, according to a statement made by **F. W. Young**, vice-president. The idea of merging two or more of the plants operated by the corporation, and locating them in Ilion, N. Y., was considered.

Holders of common stock of **Oneida Community, Ltd.**, were notified of a meeting to be held this month at the company's offices in Kenwood, N. Y., to vote on a proposal to reduce the company's capitalization from $9,000,000 to $7,800,000. Notice of the meeting issued by **J. E. Allen**, secretary, outlined the proposal to reduce the par value of each of the 240,000 authorized shares of common stock from $25 to $20 each, and the consequent reduction in the amount of the capital stock from the nine million mark to $7,800,000. The notice contained a statement from **P. B. Noyes**, president of the corporation, explaining "that through nearly three years of lessening business and lowering prices we have kept the company in sound financial position by very great reductions in both expenses and inventories. In spite of losses and paying $200,000 each year on our funded debt this company has no bank indebtedness on the last annual statement date. Unavoidable reduction of accumulated surplus has reached the point where our directors believe sound practice demands such revision of the relation between capital stock and surplus as will insure continued confidence in our financial structure."

On September 18 the "Utica Observer-Dispatch" contained a life sketch of **George L. Brunner**, and congratulated him on his 49th birthday. He is one of the founders of the **Brunner Manufacturing Company.**

Bradford Divine, president of **Divine Brothers Company**, Utica, was in charge of the trapshooting and other gun sports at the annual clambake of the Utica Rotary Club recently.—E. K. B.

Newark, New Jersey

October 1, 1932.

William J. Egan and **D. Frederick Burnett** have been appointed equity receivers of the Radio Products Co., 543 South Eleventh Street. A plan of reorganization is under way. For several months the corporation has been engaged in the completion of a miniature radio clock.

Earl Radio Corporation's receiver has reported that Earl and the **Radio Corporation of America** have settled the claims against each other. With all bankruptcy suits against Earl dropped, the receiver is ready to pay a 4 per cent dividend on all claims.

Trustees in dissolution of the **Splitdorf Electrical Company**, 392 High Street, will not be restrained by Chancery Court from selling part of the concern's assets to the **Edison-Splitdorf Corporation** for $197,000. C. A. L.

Trenton, New Jersey

October 1, 1932.

There has been no change in the metal activity in Trenton during the past month, and the prospects for the winter months are not very encouraging. Plants report that while orders are on the increase in some instances, they are not very large ones.

John A. Roebling's Sons Company had a large exhibition of copper, brass and wire products at the recent Trenton State Fair. Other metal plants had small exhibits.

Raritan Copper Works is rebuilding a two-story brick basement building at a cost of $40,000. **Pharma Chemical Company**, Bayonne, is having plans drawn for a new chemical plant to cost $40,000.

Following New Jersey concerns have been chartered at Trenton: **Alloy Products Company**, Irvington, manufacture wire; $125,000 capital. **Holland Boy Chemical Products**, Butler; $25,000 and 4,000 shares common. **Metalate Chemical Company**, Vineland; 100 shares stock. **Greenbaum's Radio, Inc.**, Paterson; manufacture radio equipment; 1,250 shares common. **Dilco Lamp Works, Inc.**, Jersey City; manufacture radio equipment; $125,000. **Associated Chemical Industries, Inc.**, Montclair; $101,500. **Tubular Finishing Machines, Inc.**, Ventnor City; manufacture tubular apparatus; $70,000. C. A. L.

Middle Western States

Detroit, Michigan

OCTOBER 1, 1932.

Little change has occurred in the metal lines during the last four weeks. The expected upward trend forecast the first of last month failed to materialize. Even the optimistic ones just now have little to say regarding the next month. For that reason, perhaps, conditions may change and bring better things to the long suffering manufacturer.

Accessory plants, not only in the Detroit area, but in other industrial sections on the Great Lakes, are doing very little. Demand for their products has not improved.

Platers' plants, like the others, are just dragging along, hoping from month to month for the expected break. Manufacturers of plumbers' and steam fitters' supplies are still under curtailed production. Manufacturing jewelers have nothing encouraging to report.

Square D Company, Detroit, recently announced the introduction of an improved line of Type C industrial switches.

Bundy Tubing Company, 4815 Bellevue Avenue, recently installed a large copper hydrogen electric welding furnace, which is said to mark an advanced step in the field of multi-welds and intricate assemblies. Articles that may be welded in a furnace of this type include castings and forgings of intricate design which can be made by assembling separate parts and copper-welding them. The process is adapted to the automotive and refrigerating industries.

Kelvinator Corporation is completing plans for the manufacture of a line of air conditioning equipment, according to an announcement from **George W. Mason,** president.—F. J. H.

Cleveland, Ohio

OCTOBER 1, 1932.

While there is much optimism in this area, general business and manufacturing are not showing any decided increases. So far as volume of production is concerned, it continues about the same as last month. Most of the plants are marking time in expectation of better things later on. The political campaign is attracting attention now, and well informed industrialists are looking for a change after that is out of the way.

Manufacturers of automobile accessories are not making the progress expected a few weeks ago. This is disappointing, for much depends on resumption of this particular industry. Nevertheless, a feeling is current that the late fall and coming winter will have much more in store than was in sight a year ago.

Bagdad Company, copper refiners, wire makers, etc., Sandusky, Ohio, is preparing for operation early in October, it is stated. F. J. H.

Chicago, Illinois

OCTOBER 1, 1932.

Rumors of increased output of farm machinery are prevalent, but no actual basis seems evident. The agricultural advance does not appear sufficient to warrant any increased activity in farm equipment lines.

Automobile and typewriter sales show increase. Wire products are up to 35 per cent of capacity, with tin plate rollings up to the same average. **Zenith Radio Corporation** has increased its number of employed and **Grigsby-Grunow's** radio department has more than doubled the number on its payroll since the end of July. Reports from the Illinois Chamber of Commerce show improvements from nearby districts. The **Williams Oil-O-Matic** factory, Bloomington, has recalled 185 employes, making a total of 309 men at work, a force as large as at any time since 1925. Day and night shifts and a seven-day week are in force at the **Hayes-Custer** stove factory.

Metal manufacturers' exhibits formed an interesting part of the Eastern Manufacturers and Importers Exhibit at the Palmer House and the Chicago Gift Show at the Merchandise Mart. Among the new concerns exhibiting at the latter was the **National-Standard Company,** Niles, Michigan, which has just brought out a new product, Wirecraft, made up into lamps, waste baskets, vases, ferneries, etc. In addition to color finishes, Wirecraft products are obtainable in brass, bronze, and silver plate.

International Business Machines Corporation, which recently removed its sales and service offices to a new location, staged a successful business equipment show at its new home from September 12 to 17.

Perfect Circle Company has been organized to manufacture an expanding device for installation inside worn aluminum pistons. It expands the piston in conformity with the wear of the cylinder, thus eliminating "piston slap." The product will first be introduced in sizes for model A Fords, with expanders for all cars using aluminum pistons to follow shortly, according to company plans.

Willys Overland Company will start production of a new half ton, six cylinder truck in several body types which it will furnish for the **International Harvester Company.**

Burpee Can Sealer Company, 215 West Huron Street, manufacturers of household canning outfits, has purchased property for an indicated $37,500 which will give it 15,000 square feet of space. This property is occupied under lease to May 1 by the **Helco Industries** and the **Duro Metal Products Company.**

New companies in Chicago include:

Indestructible Metallic Signs, Inc.; manufacture and deal in signs of all kinds; capital, 10,000 shares no par value.

Acme Machine and Tool Company has been organized with $25,000 capital.

Jackson Radio and Television Company, capital $20,000; manufacture and deal in electric appliances.

Gasthalter Pipe and Supply Company, Inc.; manufacture and deal in pipes.

American Cap and Set Screw Company, Waukegan; capital $25,000; manufacture and deal in hardware.

Wisconsin Notes

OCTOBER 1, 1932.

Milwaukee Die Casting Company, which manufactures metal parts for plumbing, refrigerators, gasoline pumps, toy making, elevators and many other devices, has its die casting machines active again after a dull summer. Officials of the concern await a quickening of orders with interest, according to **C. F. Grebe,** superintendent. The company prepares its own dies. The principal metals used are zinc and aluminum with some tin and lead. The products vary all the way from malted milk mixers to outboard motors and from toy airplanes to tools and automotive parts. The outlook for the fall is hopeful, **Charles Frantz,** sales manager, stated.

Ampco Metal, Inc., Milwaukee, engaged in compounding alloys which it sells in the form of castings, experienced a 40 per cent increase in business in August over July. Production has been stepped up to correspond with the larger volume of orders. **C. J. Zaiser,** president, says the upturn, which started the middle of August, has been much sharper than usual at this season, and business has continued to expand at about the same rate in September. Working hours have been increased, and the plant is expected to be back on full time operation before long.

C. E. Stone, president of the **Interstate Drop Forge Company,** Milwaukee, reports considerable optimism based on the fact that the first half of August, ordinarily the worst month of the year in his field, has proved to be the highest sales period of 1932. The company serves more than 40 varieties of manufacturing plants all over the country, and forges five kinds of metal, including brass, copper and aluminum. Officers of the company, besides Mr. Stone, include **L. S. Peregoy,** vice president, and **C. C. Bremer,** secretary-treasurer.

Slightly increased orders coming from widely diversified lines of industry are reported by the **Milwaukee Lock Washer Company.** July was a slow month for the concern, but orders increased in August approximately 30 per cent. Working hours at the plant have been increased somewhat to take care of the new orders.

An increase of approximately 50 per cent the first half of August over July was reported for the **Gordan Metals Corporation.** The volume of orders has mounted to such an extent that some had to be turned down because it is impossible to get enough secondary nonferrous metal, **Lacy Crolius,** president of the company, stated. The shortage is due to general industrial inactivity the last two years.—W. T. N. B.

Pacific Coast

Los Angeles, California

OCTOBER 1, 1932.

Air conditioning is a field which is expanding rapidly, and offers the metal lines a very good outlet for many types of product as well as service. The installations are made largely of metal, with nonferrous materials leading, generally. The new Edison Building here, which is one of the first buildings electrically welded throughout, is fully equipped with air conditioning equipment. It has a refrigerating plant which also heats part of the building, as well as other types of heating apparatus in some parts.

John D. Strong, research physicist at Cal-Tec University, Pasadena, has invented a metalizing process for coating silk or cotton cloth with gold, silver, platinum, etc. The product is to supplant woven materials. The process is carried on at 3000° F., and employs tungsten coils.

Diamond Metal Company, Houston, Texas, has doubled the size of its plant for manufacture of oil field equipment.

De Laval Pacific Company, Los Angeles, has been organized to market the metalizing spray gun produced by the **Metal Spray Company,** Los Angeles.

Zercolator Cold Storage Corporation, 1601 Compton Avenue, Los Angeles, makes refrigerators. **R. L. Hinckley** is president.

Kittle Manufacturing Company, Los Angeles, has a contract to produce the copper auto license plates for 1933 for the state of Arizona.

H. C. Parker, making copper and brass coils and fins for refrigerators, has moved his plant to enlarged quarters at 2627 Santa Fe Avenue, Los Angeles. He has a Navy contract for material to go to the Hawaiian Islands.

Molar Manufacturing Company, 321 North Eucalyptus Avenue, Inglewood, has started manufacture of portable and stationary air conditioning equipment for home use. The firm makes refrigerators.

Warren Arthur, Furniture, Ltd., 810 East 61st Street, Los Angeles, is making modernistic aluminum furniture.

Acme Battery Company, 337 South Anderson Street, Los Angeles, will make batteries. **L. B. Robinson** is manager.

Western States Sales Company, 3305 San Pedro Street, has set up a plant for manufacture of complete line of aluminum alloy pistons.

Standard Refrigeration Company, 1620 North Ditman Street, Los Angeles, has started making electric refrigerators. **V. F. Kirkpatrick** is general manager.

Lockheed Aircraft Corporation, Burbank, has reorganized and will take up new lines as well as continuing with the old. **Lloyd Stearman** is president.

Kinner Airplane and Motor Corporation, Glendale, has started making a new line of airplanes. **Robert Porter** is president.

Pacific Pipe and Supply Company, 1002 South Santa Fe Avenue, is making gas specialties, calibrating devices to inject chemicals into gas lines, etc. **H. F. Haldeman** is president.

Odell Manufacturing Company, 1324 Velasco Street, Los Angeles, is making safety razor blades on a large scale, and also razor sharpening devices.

Gero Corporation, 4726 Everett Avenue, Central Manufacturing District, Los Angeles, will make refrigerators. **M. E. Rogers** is vice-president.

H. S.

Other Countries

Birmingham, England

SEPTEMBER 19, 1932.

Now that the holiday season is over, industrialists are looking for a revival of orders. For a period of about one month the non-ferrous metal markets have taken on a firmer tone, and copper has risen from £27 a ton on August 2 to £37 on September 8. Industrialists regard this rise with some suspicion because they are not sure whether trade improvement justifies it, although they agree that the increase is the result of renewed confidence, and confidence is the basis of business. What they are looking for is a definite expansion in the demand for new metals by consumers, and this, generally speaking, is lacking, although here and there signs of improvement are recorded. In the lighter metal-working branches, for example, firms are getting busy on goods which will make their appearance in the retail stores for the Christmas season. It is admitted that manufacturers of the lighter forms of metalware are in a stronger position than they were twelve months ago and the prospects are certainly more encouraging.

Unemployment continues on rather a heavy scale but the increase in recent weeks has been due to the holidays rather than to any curtailing of operations through lack of orders. One very promising feature is the activity in the automobile industry. One Birmingham firm recently erected a new factory, and firms making motor accessories and components have been fully employed for some time.

The imposition of tariffs on imported goods is having an important effect on industry. The largest manufacturer of wood screws in Birmingham recently announced a reduction in price as a result of additional duties on steel and brass screws imposed by the Government on September 2. This reduction is made in anticipation of an increased demand for British products, and a consequent lowering of production costs. The duties on screws for wood made of brass, copper or an alloy containing copper, whether coated with some other metal or other substance or not, are increased in the case of those up to and including eight-gauge to an aggregate of 9d a pound, or 2½d a gross, whichever is the greater; and on those over eight-gauge to an aggregate of 6d a pound.

One of the most important results of the Ottawa Conference is the withdrawal of the Commonwealth embargo on the importation of electro- and silver-plated hollow ware. This prohibition was enforced in March, 1931, as a move to restore Australian finance, since when the large trade done by Birmingham and Sheffield firms with Australia has been at a standstill. The measure proved a very serious blow to these firms, but there is now every hope that Australia will resume buying, since there are very few plants in that country equipped for making the wares which are made in England. Unfortunately the ban on aluminum hollow ware has not been removed, and firms in Birmingham and the Midlands are suffering very keenly because of the loss of this trade.—J. A. H.

Business Items--Verified

Eureka Vacuum Cleaner Company, Detroit, Mich., has reopened its plant after a year's shutdown, in order to build up depleted inventories.

Seth Thomas Clock Company, Thomaston, Conn., has dropped temporarily the project of building an addition on South Main Street.

Western Cartridge Company, Alton, Ill., has resumed operations following partial shut down for a few weeks, reinstating about 800 employees.

Otis Elevator Company have been awarded a $600,000 contract for furnishing and installing 14 new elevators in the Oliver Building, Pittsburgh, Pa.

Fitzgerald Manufacturing Company, Waterbury, Conn., has submitted a bid of $15,000 for plant of Strand and Sweet division of Polymet Corporation of New York.

New Departure Ball Bearing Company plant at Bristol, Conn., closed since August 4, has reopened and is resuming operations at about the same schedules as when closed down.

H. V. Knight and Son, Inc., Seneca Falls, N. Y., has purchased pattern letter business of A. W. Brim Company, same city. Knight company has been making pattern letters for 60 years.

American Smelting and Refining Company, New York, is negotiating for acquisition of control of **Federated Metals Corporation,** New York, large scrap metal dealing and reclaiming firm.

Milwaukee Stamping Company, 824 South 72nd Street, Milwaukee, Wis., reports better orders and increase of 20 per cent in working force, in advance of seasonal upturn, due to low customers' inventories.

Worthington Pump and Machinery Corporation, Harrison, N. J., has ar-

ranged for joint use of the manufacturing, engineering and sales and service facilities of its meter division and those of the **Gamon Meter Company,** Newark, N. J.

American Brass Company, Waterbury, Conn., will occupy Booth D-16 at the National Metal Exposition, October 3-7, 1932, at the 174th Regiment Armory, Buffalo, N. Y. Welding of Everdur metal will be featured, and many of the company's products will be on display.

Waltham Watch Company, Waltham, Mass., recently recalled 850 employees—approximately 1,100 are now employed at the plant. At the **Waterbury Clock Company,** Waterbury, Conn., 400 people returned to work, bringing the total working force up to 1,500; 1,000 more are expected to be added within the month, according to officials.

Florence Stove Works, Boston, Mass., with plants in Illinois and Massachusetts, has reopened with a full schedule employing 500 men. **White-Warner Company** is the third Massachusetts stove plant to resume active schedule of production within a period of two weeks. Workers in all departments have been recalled.

Otto Bernz Company, Newark, N. J., has been acquired by **L. O. Graves** and **A. Lapine,** executive heads of **Graves Elevator Company,** 280 Lyell Avenue, Rochester, N. Y. The Bernz company makes plumbers' torches, furnaces, tools and supplies. Its equipment will be removed to Rochester and installed in part of the Graves plant. **Joseph Wollman** and **Arthur Pflath,** former Bernz men, will continue as general manager and production manager, respectively of the Bernz division at Rochester.

Empire Industries, Inc., 10316 Madison Avenue, Cleveland, Ohio, on September 1 changed its name to **Kelly Plating Company.** The move follows dissolution of **Globe Rustproofing Company,** Cleveland, and addition of some of the latter's equipment to that of the former Empire firm. **W. J. McNamara,** president of Empire since its establishment, has retired, and **John N. Kelly,** for the past 10 years president of Globe, becomes owner of Kelly Plating Company. The firm as now formed is said to be one of the largest job plating shops in Ohio.

Newark Galvanizing Company, Inc., 25 Verona Avenue, Newark, N. J., is running on full-time production schedule giving employment to close to normal working quota. The company has secured renewal of contract with the Brooklyn Navy Yard for annual requirements of hot-dip galvanizing, with increased tonnage. It is a subsidiary of **Atlas Fence Company. Frank C. Zuch,** president of the company, says: "We note a decided improvement in the amount of tonnage coming in monthly for hot dip galvanizing. This tonnage that we galvanize for other firms emanates principally from municipal construction projects. We have noted a sincere interest in the better grade of galvanizing where firms are assured of a pure zinc coating in preference to so-called commercial hot dip galvanizing."

Metal Market Review

By R. J. HOUSTON

D. Houston and Company, Metal Brokers, New York

October 1, 1932.

Copper

The September opening of the copper market was at 5⅞ cents delivered Connecticut points, and early developments carried the market to 6¼ cents. Buying for foreign account was in substantial volume, and the expanding demand from abroad at rising prices gave a mild stimulus to the local situation. Transactions for domestic delivery, however, were on a moderate scale. Consumption in general shows improvement, and the list of revised prices for manufactured products shows encouraging gains.

Export sales in recent weeks were a feature of the situation. The sales to foreign buyers stimulated activity in the London Standard market where operations were in heavy volume on an advancing market. In less than a six weeks' period ending September 6, Standard copper in London advanced £10, 10s per ton and Electrolytic refined £9 per ton. In contrast with the quiet condition of the American market the performance abroad is conspicuous for the improvement and activity of the foreign movement.

Producers and manufacturers in this country are working on a low level of both production and sales. The fabricating industry, however, showed a distinct improvement at leading plants and there is some basis for a little better outlook in consuming circles.

Zinc

A pronounced rally both in price and activity was recorded in the zinc market in September. The opening was active and firm on the basis of 3.10c East St. Louis. Buying continued in substantial volume as the price moved upward rapidly to 3.25c and in a brief time to 3.40c Western delivery. Prices stiffened further until 3.45c to 3.50c East St. Louis was reached, but at this level the advance was checked and gradually the market worked itself back to 3.25c to 3.30c St. Louis basis. Demand turned dull and futures displayed an easier under tone. Zinc statistics during August recorded a decrease in stocks of 4,704 tons, the first decrease that has occurred since last March. Shipments for August showed a 50 per cent gain compared with those for July. Production dropped to the low point of 13,404 tons. The favorable statement contributed the incentive to better prices and more active buying.

Tin

There was definite indication early in September that tin was headed upward when the market for prompt Straits tin advanced 1¼ cents per pound in the first seven days of the month. Strength and activity developed at the beginning, with buyers aggressive and eager to cover requirements at quotations current at that time. Early prices were on the basis of 24⅜ cents for prompt Straits tin. Active demand set in strong, and in a short time the market rose to 25⅝ cents. It tapered off again in a few days to 24½ cents on a slowing down of buying. Foreign advices revealed a weak undertone and a sharp decline at London of £4. 15s 0d per ton on September 19. Prices here reacted to 23⅞ cents as a reflection of the change in sentiment abroad and the general apathy of local buyers.

Lead

The initial opening was firm and moderately active on the basis of 3.60c New York and 3.45c East St. Louis. These features prevailed during most of the first half of September. The decrease in refined stocks of 4,829 tons reported for August was largely owing to the heavy shipments for that month of 28,248 tons, which compared with 19,723 tons in July. The improved statistical position of lead gave conservative buyers a mild increase of confidence in the situation for the time being. Consumers covered September requirements freely and in addition purchased a large tonnage for shipment in October.

Subsequently demand fell off, and despite the more favorable statistics prices sagged off to 3.50c New York basis and later to 3.40c New York and 3.25c East St. Louis. These figures represented a decline of $4 per ton from September 19 to September 21.

Aluminum

Aluminum demand was in restricted volume lately. Prices for the new metal, however, continue steady, although that has been a chief feature for a long time. Demand for remelted and scrap aluminum shows some improvement. Prices of the latter fluctuate slightly according to supplies available, but these grades have been featured by firmness recently. Consumers are inclined to carry larger supplies in anticipation of increased requirements. A distinctly better feeling was reported in trade circles, and a better miscellaneous demand was noted at middle west centers of consumption. Buying by the automotive industry, however, was relatively small.

Antimony

The antimony market fluctuated between narrow limits. There were some recent transactions reported but for moderate lots. Firmer conditions prevailed in the primary Chinese market lately, and for a time the quotation for both prompt and future deliveries was raised to 5.75c duty paid. Demand was small and this level did not last long. In view of the apathy of buyers and the extremely light inquiry round lots of Chinese regulus were quoted at 5.65c duty paid.

Quicksilver

Trading in quicksilver remains on a restricted scale. Prices are slightly higher, however, and quote $46 to $47 per flask at New York.

Platinum

Easier conditions prevail in the market for refined platinum. Demand is quiet on the basis of $31 per ounce. A low level of consumption and large stocks on hand and the competition of old platinum metal all tend to keep prices low.

Silver

The silver market fluctuated within a narrow range lately. There was active liquidation for Far Eastern account, and the selling pressure from China and India was reflected in slightly lower quotations both at London and New York. The month opened at 28⅛ cents per ounce and declined to 27½ cents in second half. September stocks of silver at China and India are very heavy. Erratic movements are therefore likely to continue until some stabilization factor controls the situation. Economists maintain that there is an inaquate supply of gold to carry on the commerce and business of the world. With silver placed upon a purely commodity basis its monetary value has declined to an extremely low level.

Old Metals

There was recent reappearance of buying interest in the market for scrap metals, especially copper and brass material. Exporters and domestic buyers were eager to make purchases in good volume. Offerings however, were on restricted scale as holders appeared inclined to reserve their accumulations for better prices.

The Wrought Metal Business

By J. J. WHITEHEAD

President, Whitehead Metal Products Company of New York, Inc.

October 1, 1932.

Business seems to be getting better. Car loadings are increasing at a rate greater than seasonal. Actual orders are increasing, and the number of inquiries for copper and copper products, aluminum, nickel and Monel are rising.

The American Radiator and Standard Sanitary Corporation was reported on September 21 to have covered its 1933 requirements for copper, in addition to making purchase of 50,000 tons of pig iron and substantial amounts of iron and steel scrap, lumber and other materials for future delivery. This company has been noted for making purchases at advantageous points in the market.

A large department store in New York is known to be stocking up on everything. A large fabricating company producing a metal product is running full tilt on some of its machines building up inventory of finished product.

Prices are firming somewhat, and if the scheme of taking large quantities of all kinds of commodities out of the market is ultimately consummated, the prices of such materials are certainly going to increase. It is generally believed that increased prices of commodities, and especially metals, is not so far away as one would suppose. Sight should not be lost of the fact that the producers are carrying the entire load and that this load includes the inventories that would normally be in the hands of users.

Everywhere a greater feeling of optimism prevails. Confidence that the worst is over is general, and from here on periodic spurts will probably take place which will be followed by periods of let down. The trend, however, is toward better business.

A general revival, even if of only moderate proportions at present will immediately be reflected in the copper and brass industries, as well as aluminum and nickel alloys. These materials are essential and must be used for such a wide variety of products that no upturn is possible without an increased demand for them occurring. The electrical industry, building, automobile, aviation, and others use large tonnages of these metals in thousands of products, and consequently the fact that inquiries are increasing for such products, as well as orders, plainly shows that the situation is improving.

Will Use Bronze Windows

The Supervising Architect of the United States Treasury Department has signed an order specifying the use of bronze for 60 per cent of the windows of the new Post Office Department building in Washington.

Daily Metal Prices for the Month of Sept., 1932

Record of Daily, Highest, Lowest and Average Prices and the Customs Duties

	1	2	5*	6	7	8	9	12	13	14	15	16
Copper c/lb. Duty Free												
Lake (Del.)	6.00	6.125	....	6.125	6.375	6.375	6.375	6.375	6.375	6.375	6.375	6.375
Electrolytic (Conn.)												
Casting (f.o.b. ref.)	6.00	6.00	....	6.00	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.125
Zinc (f.o.b. St. L.) c/lb. Duty 1¼c/lb.	5.75	5.875	....	5.875	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
Prime Western												
Brass Special	3.10	3.25	....	3.40	3.40	3.40	3.50	3.50	3.425	3.425	3.40	3.40
Tin (f.o.b. N. Y.) c/lb. Duty Free	3.15	3.30	....	3.45	3.45	3.45	3.55	3.55	3.475	3.475	3.45	3.45
Straits	24.375	28.125	....	25.40	25.625	25.60	25.30	24.80	24.50	24.75	24.50	24.50
Pig 99%	23.25	23.95	....	24.30	24.50	24.50	24.25	23.75	23.50	23.75	23.50	23.50
Lead (f.o.b. St. L.) c/lb. Duty 2½c/lb.												
Aluminum c/lb. Duty 4c/lb.	3.45	3.45	....	3.45	3.45	3.45	3.45	3.45	3.45	3.45	3.45	3.45
Nickel c/lb. Duty 3c/lb.	23.30	23.30	....	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30
Electrolytic 99.9%	35	35	....	35	35	35	35	35	35	35	35	35
Shot (from remelted electrolytic)	36	36	....	36	36	36	36	36	36	36	36	36
Pellets 99.5-100%	40	40	....	40	40	40	40	40	40	40	40	40
Antimony (Ch. 99%) c/lb. Duty 2c/lb.	5.50	5.50	....	5.50	5.50	5.50	5.50	5.75	5.75	5.75	5.65	5.65
Silver c/oz. Troy Duty Free	28.375	28.25	....	28.875	28.625	28.375	28.125	28.125	27.625	28.125	27.625	27.625
Platinum $/oz. Troy Duty Free	32.00	32.00	....	32.00	32.00	32.00	32.00	32.00	32.00	32.00	30.00	30.00

	19	20	21	22	23	26	27	28	29	30	High	Low	Aver.
Copper c/lb. Duty Free													
Lake (Del.)	6.375	6.375	6.375	6.375	6.375	6.375	6.375	6.375	6.375	6.375	6.375	6.00	6.333
Electrolytic (Conn.)	6.125	6.125	6.125	6.25	6.25	6.25	6.25	6.25	6.125	6.00	6.25	6.00	6.173
Casting (f.o.b. ref.)	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	5.75	5.976
Zinc (f.o.b. St. L.) c/lb. Duty 1¼c/lb.													
Prime Western	3.30	3.30	3.25	3.25	3.25	3.25	3.25	3.25	3.20	3.20	3.50	3.10	3.319
Brass Special	3.35	3.35	3.30	3.30	3.30	3.30	3.30	3.30	3.25	3.25	3.55	3.15	3.369
Tin (f.o.b. N. Y.) c/lb. Duty Free													
Straits	23.875	24.35	24.60	24.80	24.85	24.65	24.40	24.75	24.70	24.50	25.625	23.875	24.760
Pig 99%	22.875	23.35	23.60	23.75	23.80	23.65	23.375	23.70	23.65	23.50	24.50	22.875	23.714
Lead (f.o.b. St. L.) c/lb. Duty 2½c/lb.	3.45	3.45	3.25	3.25	3.25	3.15	3.00	2.85	2.85	2.95	3.45	2.85	3.305
Aluminum c/lb. Duty 4c/lb.	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30	23.30
Nickel c/lb. Duty 3c/lb.													
Electrolytic 99.9%	35	35	35	35	35	35	35	35	35	35	35	35	35
Shot (from remelted electrolytic)	36	36	36	36	36	36	36	36	36	36	36	36	36
Pellets 99.5-100%	40	40	40	40	40	40	40	40	40	40	40	40	40
Antimony (Ch. 99%) c/lb. Duty 2c/lb.	5.65	5.65	5.65	5.65	5.65	5.65	5.65	5.65	5.65	5.65	5.75	5.50	5.621
Silver c/oz. Troy Duty Free	27.625	27.50	27.625	27.875	27.50	27.50	27.375	27.50	27.50	27.375	28.875	27.375	27.863
Platinum $/oz. Troy Duty Free	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	32.00	30.00	30.857

*Holiday.

Metal Prices, October 3, 1932

(Duties mentioned refer to U. S. tariffs on imports, as given in the Tariff Act of 1930.)

NEW METALS

Copper: Lake, 6.375. Electrolytic, 6.00. Casting, 5.875.
Zinc: Prime Western, 3.10. Brass Special, 3.15.
Tin: Straits, 24.20. Pig, 99%, 23.125.
Lead: 3.00. Aluminum, 23.30. Antimony, 5.625.
Duties: Copper, 4c. lb.; zinc, 1¾c. lb.; tin, free; lead, 2½c. lb.; aluminum, 4c. lb.; antimony, 2c. lb.; nickel, 3c. lb.; quicksilver, 25c. lb.; bismuth, 7½%; cadmium, 15c. lb.; cobalt, free; silver, free; gold, free; platinum, free.

Nickel: Ingot, 35. Shot, 36. Elec., 35. Pellets, 40.
Quicksilver: Flash, 75 lbs., $48. **Bismuth,** 85.
Cadmium, 55. **Cobalt,** 97%, $2.50. **Silver,** oz., Troy (N. Y.) official price October 5, 27.375.
Gold: oz., Troy, $20.67. **Platinum,** oz., Troy, $30-$35.

INGOT METALS AND ALLOYS

	Cents lb.	Duty
Brass Ingots, Yellow	5¼ to 6½	45%
Brass Ingots, Red	6¼ to 7½	45%
Bronze Ingots	6¾ to 10	45%
Aluminum Casting Alloys	7 to 22	4c. lb.
Manganese Bronze Castings	16 to 35	45%
Manganese Bronze Ingots	6½ to 10	45%
Manganese Bronze Forgings	26 to 35	45%
Manganese Copper, 30%	18 to 25	25%
Monel Metal Shot or Blocks	28	25%
Phosphor Bronze Ingots	7½ to 10	45%
Phosphor Copper, guaranteed 15%	10 to 16	3c. lb.
Phosphor Copper, guaranteed 10%	9¼ to 14½	3c. lb.
Phosphor Tin, no guarantee	30½ to 45	Free
Silicon Copper, 10%	18 to 30	45%
Iridium Platinum, 5%	$33.00	Free
Iridium Platinum, 10%	$34.00	Free

OLD METALS

Dealers' buying prices, wholesale quantities	Cents lb.	Duty
Heavy copper and wire, mixed	4¼ to 4⅜	Free
Light copper	3⅜ to 3⅝	Free
Heavy yellow brass	2⅜ to 2⅝	Free
Light brass	1⅞ to 2⅛	Free
No. 1 composition	3¼ to 3½	Free
Composition turnings	3 to 3¼	Free
Heavy soft lead	2⅛ to 2¼	2⅛c. lb.
Old zinc	1¼ to 1⅜	1½c. lb.
New zinc clips	1¾ to 2	1½c. lb.
Aluminum clips (new, soft)	9½ to 10½	4c. lb.
Scrap aluminum, cast, mized	3 to 3¼	4c. lb.
Scrap aluminum, sheet (old)	7 to 7½	4c. lb.
No. 1 pewter	14 to 15	Free
Electrotype or stereotype	2⅛ to 2¼	2⅛c. lb.*
Nickel anodes	20¼ to 22¼	10%
Nickel sheet clips; rod ends (new)	23¼ to 24¼	10%
Monel scrap	5½ to 9	3c. lb.

* On lead content.

Wrought Metals and Alloys

The following are net BASE PRICES per pound, to which must be added extras for size, shape, small quantity, packing, etc., as shown in manufacturers' price lists, effective September 8, 1932.

COPPER MATERIAL

	Net base per lb.	Duty
Sheet, hot rolled	15⅜c.	2½c. lb.
Bare wire, soft	8c.	25%
Seamless tubing	14⅜c.	7c. lb.
Soldering coppers	15⅞c.	45%

NICKEL SILVER

Net base prices per lb. (Duty 30% ad valorem.)

Grade "A" Sheet Metal		Wire and Rod	
10% Quality	21⅛c.	10% Quality	24c.
15% Quality	23¼c.	15% Quality	28¾c.
18% Quality	24½c.	18% Quality	31⅝c.

ALUMINUM SHEET AND COIL

(Duty 7c. per lb.)

Aluminum sheet, 18 ga., base, ton lots, per lb. 32.30
Aluminum coils, 24 ga., base price 30.00

ROLLED NICKEL SHEET AND ROD

(Duty 25% ad valorem, plus 10% if cold worked.)

Net Base Prices

Cold Drawn Rods	50c.	Cold Rolled Sheet	60c.
Hot Rolled Rods	45c.	Full Finished Sheet	52c.

MONEL METAL SHEET AND ROD

(Duty 25% ad valorem, plus 10% if cold worked.)

Hot Rolled Rods (base)	35	Full Finished Sheets (base)	42
Cold Drawn Rods (base)	40	Cold Rolled Sheets (base)	50

SILVER SHEET

Rolled sterling silver (October 5) 30.625c. per Troy oz. upward according to quantity. (Duty free.)

BRASS MATERIAL—MILL SHIPMENTS

Net base prices per pound

Net per lb.	High Brass	Low Brass	Bronze	Duty
Sheet	12½c.	13⅝c.	14c.	4c. lb.
Wire	12½c.	13⅝c.	14c.	25%
Rod	10¼c.	13⅝c.	14c.	4c. lb.
Open seam tubing	20½c.		22c.	25%
Angles, channels	20½c.		22c.	12c. lb.
Seamless tubing	15¼c.		15¾c.	8c. lb.

TOBIN BRONZE AND MUNTZ METAL

Net base prices per pound.	(Duty 4c. lb.)
Tobin Bronze Rod	14c.
Muntz or Yellow Metal Sheathing (14"x18")	14⅝c.
Muntz or Yellow Rectangular sheet other sheathing	14⅝c.
Muntz or Yellow Metal Rod	11¼c.

ZINC AND LEAD SHEET

	Cents per lb. Net Base	Duty
Zinc sheet, carload lots, standard sizes and gauges, at mill, less 7 per cent discount	9.00	2c. lb.
Zinc sheet, full casks (jobbers' price)	9.25	2c. lb.
Zinc sheet, open casks (jobbers' price)	10.00 to 10.25	2c. lb.
Full Lead Sheet (base price)	6.50	2⅜c. lb.
Cut Lead Sheet (base price)	6.75	2⅜c. lb.

BLOCK TIN, PEWTER AND BRITANNIA SHEET

(Duty free)

This list applies to either block tin or No. 1 Britannia Metal Sheet, No. 23 B. & S. Gauge, 18 inches wide or less; prices are all f. o. b. mill:

500 lbs or over ..... 15c. above N. Y. pig tin price
100 to 500 lbs. ..... 17c. above N. Y. pig tin price
Up to 100 lbs. ..... 25c. above N. Y. pig tin price

Lighter gauges command "extras" over the above prices.

Supply Prices, October 3, 1932

ANODES

Copper: Cast ..... 16¼c. per lb.
Rolled, sheets, trimmed ..... 14¼c. per lb.
Rolled, oval ..... 13½c. per lb.
Brass: Cast ..... 14½c. per lb.
Zinc: Cast ..... 08¾c. per lb.

Nickel: 90-92% ..... 41c. to 45c. per lb.
95-97% ..... 42c. to 46c. per lb.
99% cast, 44c. to 48c.; rolled, depolarized, 45c. to 49c.
Silver: Rolled silver anodes .999 fine were quoted September 6 from 30.625c., per Troy ounce upward, depending upon quantity.

WHITE SPANISH FELT POLISHING WHEELS

Diameter	Thickness	Under 50 lbs.	50 to 100 lbs.	Over 100 lbs.
10-12-14 & 16	1" to 2"	$2.85/lb.	$2.55/lb.	$2.35/lb.
10-12-14 & 16	2 to 3½	2.75	2.45	2.25
6-8 & over 16	1 to 2	2.95	2.65	2.45
6-8 & over 16	2 to 3½	2.90	2.60	2.35
6 to 24	Under ½	4.15	3.85	3.65
6 to 24	½ to 1	3.85	3.55	3.35
6 to 24	Over 3½	3.25	2.95	2.75
		Any Quantity		
4 to 6	Under ½,	$4.90	½-1, $4.75	1 to 3, $4.65
1½ to 4	"	5.45	" 5.30	" 5.25
1 to ½	"	5.75	" 5.60	" 5.50

Extras: 25c. per lb. on wheels, 1 to 6 in. diam., over 3 in. thick.
On grey Mexican wheels deduct 10c. per lb. from above prices.

COTTON BUFFS

Full disc open buffs, per 100 sections when purchased in lots of 100 or less:

11" 20 ply 64/68 Unbleached	$15.70 to 16.60
14" 20 ply 64/68 Unbleached	23.40 to 27.40
11" 20 ply 80/92 Unbleached	18.45 to 18.70
14" 20 ply 80/92 Unbleached	27.52 to 31.10
11" 20 ply 84/92 Unbleached	23.41 to 24.05
14" 20 ply 84/92 Unbleached	33.40 to 39.90

Sewed Pieced Buffs, per lb., bleached ..... 41c. to 70c.

CHEMICALS

These are manufacturers' quantity prices and based on delivery from New York City.

Acetone	lb.	.09¾-.14
Acid—Boric (Boracic) granular, 99½+% ton lots	lb.	.04½-.05
Chromic, 75 to 400 lb. drums	lb.	.12 -.17½
Hydrochloric (Muriatic) Tech., 20 deg., carboys	lb.	.02
Hydrochloric, C. P., 20 deg., carboys	lb.	.06
Hydrofluoric, 30%, bbls	lb.	.08-.12
Nitric, 36 deg., carboys	lb.	.06-.06½
Nitric, 42 deg., carboys	lb.	.07-.08
Sulphuric, 66 deg., carboys	lb.	.02
Alcohol—Butyl	lb.	11.30-18.00
Denatured drums	gal.	.475-.476
Alum—Lump, barrels	lb.	.03¾-.04
Powdered, barrels	lb.	.03½-.05
Ammonia, aqua, 26 deg., drums, carboys	lb.	.02¾-.05
Ammonium—Sulphate, tech., bbls.	lb.	.03½-.05
Sulphocyanide	lb.	.28-.37
Arsenic, white, kegs	lb.	.04½-.05
Asphaltum	lb.	.35
Benzol, pure	gal.	.58
Borax, granular, 99½+%, ton lots	lb.	.02¼-.02¾
Cadmium oxide, 50 to 1,000 lbs	lb.	.55
Calcium Carbonate (Precipitated Chalk)	lb.	.05¾-.07½
Carbon Bisulphide, drums	lb.	.05½-.12
Chrome Green, bbls	lb.	.19
Chromic Sulphate	lb.	.30-.40
Copper—Acetate (Verdigris)	lb.	.20
Carbonate, bbls.	lb.	.14-.20
Cyanide (100 lb. kgs.)	lb.	.39
Sulphate, bbls.	lb.	2.75-5.25
Cream of Tartar Crystals (Potassium Bitartrate)	lb.	.20¾-.20½
Crocus	lb.	.15
Dextrin	lb.	.05-.08
Emery Flour	lb.	.06
Flint, powdered	ton	$30.00
Fluorspar, bags	lb.	.04½
Gold Chloride	oz.	$12.00
Gum—Sandarac	lb.	.26
Shellac	lb.	.32-.34
Iron Sulphate (Copperas), bbls	lb.	.01½
Lacquer Solvents	gal.	.85
Lead—Acetate (Sugar of Lead)	lb.	.09-.13
Yellow Oxide (Litharge)	lb.	.12½
Mercury Bichloride (Corrosive Sublimate)	lb.	$1.58
Methanol, 100% synth., drums	gal.	.41½
Nickel—Carbonate, dry bbls.	lb.	.32
Chloride, bbls.	lb.	.16-.21
Salts, single, 300 lb. bbls	lb.	.10½-.13
Salts, double, 425 lb. bbls	lb.	.10½-.13
Paraffin	lb.	.05-.06
Phosphorus—Duty free, according to quantity	lb.	.35-.40
Potash Caustic Electrolytic 88-92% broken, drums	lb.	.06¾-.08½
Potassium—Bichromate, casks (crystals)	lb.	.08½
Carbonate, 96-98%	lb.	.06⅝
Cyanide, 165 lbs. cases, 94-96%	lb.	.50
Pumice, ground, bbls	lb.	.02½
Quartz, powdered	ton	$30.00
Rosin, bbls.	lb.	.04½
Rouge—Nickel, 100 lb. lots	lb.	.25
Silver and Gold	lb.	.65
Sal Ammoniac (Ammonium Chloride) in bbls	lb.	.05-.05½
Silver—Chloride, dry, 100 oz. lots	oz.	.24½-.27¼
Cyanide (fluctuating)	oz.	.31¾-.37½
Nitrate, 100 ounce lots	oz.	.20¼-.23¼
Soda Ash, 58%, bbls	lb.	.023
Sodium—Cyanide, 96 to 98%, 100 lbs	lb.	.16½-.22
Beryllium fluoride ($2NaF.BeF_2$)	lb.	4.30-7.00
Hyposulphite, kegs, bbls	lb.	.03½-.06½
Metasilicate	lb.	.05 -.06¼
Nitrate, tech., bbls.	lb.	.03¼-.07
Phosphate, tech., bbls	lb.	.03¾
Silicate (Water Glass), bbls	lb.	.01½
Stannate, fluctuating	lb.	.22
Sulphocyanide	lb.	.30 -.45
Sulphur (Brimstone), bbls.	lb.	.02
Tin Chloride, fluctuating, 100 lb. kegs	lb.	.25
Tripoli, powdered	lb.	.03
Wax—Bees, white, ref. bleached	lb.	.60
Yellow, No. 1	lb.	.45
Whiting, Bolted	lb.	.02½-.06
Zinc—Carbonate, bbls.	lb.	.11
Chloride, drums, bbls.	lb.	.07½-.10
Cyanide (100 lb. kegs)	lb.	.38
Sulphate, bbls.	lb.	.03½